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THE COAL TAR COLOURS

OF

FARBWERKE VORM. MEISTER LUCIUS & BRÜNING
HOECHST ON MAIN, GERMANY

AND THEIR

APPLICATION IN DYEING

COTTON

AND OTHER VEGETABLE FIBRES.

THIRD VOLUME.

H. A. METZ & CO.
122 HUDSON STREET, NEW YORK,
SOLE AGENTS FOR THE U. S. A.

1907.

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PATTERNS PRODUCED ON A LARGE SCALE.

The manifold uses to which the various classes of goods are put, require a careful selection of the dyestuffs, as not only the exact shade must be produced but also the fastness of that particular class of goods must be taken into consideration.

In the following pages we illustrate the practical application of our dyestuffs by a series of dyed patterns.

In practice it is not always advisable to produce the greatest fastness, as competition (especially where wages are to be considered), often compels the dyers and manufacturers to adopt the cheapest method, the most productive and cheapest dyestuffs, and the simplest process of dyeing. This is especially the case in the Lining branch.

The following patterns produced on a large scale could, therefore, certainly have been dyed with greater fastness, but cheapness being the principal object, they only possess the qualities indispensable for their eventual employment.

A. LINING BRANCH.

The chief articles of this branch are represented on pages 16 to 23. In point of quantity it is the most considerable branch of piece dyeing, and the most varied as regards dyeing and the articles to be dyed.

Linings are dyed on the jigger, less frequently in the cistern or on the hank dyeing machine (hank wash machine). For Black dyeing in large establishments the continuous dyeing machine is preferred to the jigger. Dyeing by padding is only advantageous when large lots of goods are to be dyed the same shade.

As a rule this method will rarely be resorted to for less than 50 pieces of about 65 yards each. After being dried on cylinders the Linings are first starched. The finishing prepares for Blacks are coloured with logwood, bichrome and copper vitriol; for other dark shades with suitable basic colours.

After finishing or starching, which is done on ordinary or friction starching machines, according to the filling to be given to the goods, they are dried on the cylinder drying machine, left to cool, and then sprinkled more or less with water, according to the requirements of the article.

The sprinkled cloth remains for 12 to 24 hours rolled up firmly and evenly on rollers in lots of 350 yards each, so that the moisture may be evenly distributed. The further treatment depends on the article, and can be varied very much.

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Below are some finishing processes for Linings produced on a large scale.

1. Black Double Cloth.

100 galls 500 Litres of Finish
(for 1200 metres).

10 lbs	2,5	kg fat	15 minutes in a closed finishing tub.
2 lbs	1	kg palm fat	
$^{2}/_{5}$ lbs	0,2	kg calc. soda	
$^{1}/_{25}$ lbs	0,02	kg bichrome	
12 galls	60	litres logwood decoction	
20 lbs	10	kg wheat starch	
40 lbs	20	kg potato starch	

Finished once on both sides, dried, the finish slightly diluted, again finished on both sides, dried, sprinkled, allowed to lie for a day, and mangled.

2. Black Shirting.

Mangled cloth.

100 galls 500 Litres of Finish
(for 1200 metres).

35 lbs	17,5	kg potato flour	boil for 30 minutes.
25 lbs	12,5	kg wheat starch	
5 lbs	2,5	kg fat	
2 lbs	1	kg palm fat	
$^{1}/_{2}$ lbs	0,25	kg calc. soda	
16 galls	80	litres logwood decoction	
$^{1}/_{25}$ lbs	0,02	kg bichrome	

Finished on both sides, dried on drying cylinders, starched again with the slightly diluted finishing prepare, dried again, sprinkled, allowed to lie on rollers for a day, and mangled on the hydraulic mangle.

3. Black Shirting.

Calandered Cloth.

100 galls 500 Litres of Finish
(for 2400 Metres).

80 lbs	40	kg potato flour	heated to the boil in an open vessel.
16 galls	80	litres logwood decoction	
$^{2}/_{25}$ lbs	0,04	kg bichrome	

Finished once on both sides, dried on drying cylinders, sprinkled, allowed to lie for a day, and passed the same side three times warm through the friction calander.

Note: Light coloured calandered Shirtings are finished in the same manner, but with an uncoloured finish.

4. Black Glacé.

100 galls 500 litres of Finish
(for 1800 metres).

3 lbs	1,5	kg beeswax	boiled till the wax is dissolved.
$^{3}/_{50}$ lbs (Say 15 $^{1}/_{2}$ drs)	0,03	kg bichrome	
6 galls	30	litres logwood decoction	
		Then are added:	boiled moderately fast for 15 minutes in a closed finishing tub.
62 galls	310	litres water	
6 galls	30	litres logwood decoction	
		Then further added:	
40 lbs	20	kg wheat starch in	
10 galls	50	litres water, and	
20 lbs	10	kg potato starch in	
10 galls	50	litres water	

Finished once on both sides, dried, sprinkled, then the seams overlaid so that they adhere to one another, sprinkled again and the goods allowed to lie for a day. Calandered on the friction calander — about 250 metres on each roller, — Then passed hot three times with wax through both cylinders with friction, and three times without wax with friction between steel- and paper rollers.

Logwood Decoction.

100 lbs 50 kg rasped fermented logwood are boiled with
60 galls 300 litres water during 2 hours.

5. Finish for Embossed Goods.

100 galls 500 litres of Finish
(for 1800 metres).

25 lbs	12,5	kg wheat flour	boiled for 10 minutes.
25 lbs	12,5	kg potato flour	
4 lbs	2	kg Japanese wax	
2 lbs	1	kg softening	

Sprinkled after finishing and cooling, allowed to lie for a day, then calandered on the friction calander, and finally embossed.

6. Finish for Croisé.

100 galls 500 litres of Finish
(for 2400 metres).

25 lbs	12,5	kg wheat starch	slowly boiled for 15 minutes in a closed vessel. China clay is tinted as required.
8 lbs	4	kg potato flour	
40 lbs	20	kg china clay	
1 lbs	0,5	kg soft soap	
1 lbs	0,5	kg cocoa fat	
3 $^{1}/_{5}$ pints	2	litres glycerine	

Note: For heavy Croisés less China clay and more glycerine is used; e. g. 10 grs China clay and 3 litres glycerine. The goods are once finished on both sides, dried on drying cylinders, and allowed to lie for a day after being sprinkled. They are then finished with slight pressure on the friction calander with heated steel roller.

7. Pocketing Twill.

100 galls 500 litres of Finish
(for 1800 metres).

24 lbs	12 kg	wheat starch	boiled for 10 minutes.
$4\,^4/_5$ pints	3 litres	glycerine	
1 lbs	0,5 kg	Marseilles soap	
$^2/_5$ lbs	0,2 kg	olive oil	

The Finish is tinted as required. The goods are finished once on both sides, dried on drying cylinders, sprinkled and mangled.

8. Finish for heavy Cotton Cloths.

100 galls 500 litres of Finish
(for 3000 metres).

60 lbs	30 kg	dextrine	boiled for 10 minutes.
30 lbs	15 kg	potato flour	
50 lbs	25 kg	bitter salts	
6 lbs	3 kg	Turkey red oil	
4 lbs	2 kg	Marseilles soap	

Finished once on both sides, dried on drying cylinders, sprinkled twice, and, rolled up lightly, allowed to lie for 24 hours.

MERCERISED PIECE GOODS.

Mercerised fabrics are dyed in the same manner as non-mercerised goods. The same dyeing methods and the same machines are used.

But since mercerising increases the affinity of the dyestuffs for cotton, the dyebaths must be composed in such a manner that the absorption of the dyestuffs is retarded as much as possible. In working with Dianil colours, therefore, the quantity of salt must be reduced by about half, with Thiogene Colours the quantity of sodium sulphide must be increased, that of salt diminished. For basic colours the goods must previously be mordanted in a bath about 25 % weaker.

Above all care must be taken that the goods are not entered at too high a temperature, and, when necessary, be brought to the boil very gradually. It is advisable to add the colour solution to the bath in several portions. An addition of Turkey red oil facilitates the equalizing of Dianil- and Thiogene Colours. (Compare vol I, page 136.)

The process of mercerisation is more fully described in part IV of this work.

B. ARTICLES FOR BOOKBINDING.

These articles serve as imitations of leather in the bookbinding trade. They are manufactured either from linen or cotton fabrics. The linen cloths for bookbinders are chiefly made in black or darkgreen colours, and used almost exclusively for account books. The fabrics must be finished as close as possible, in order to prevent the glue from striking through.

Finish for Darkgreen.
500 Litres
(for about 800 metres).

15 lbs	7,5 kg	glue (previously soaked)	boiled for 15 minutes.
5 lbs	2,5 kg	tallow	
2 lbs	1 kg	palm fat	
$^3/_{10}$ lbs	0,15 kg	Brilliant Green cryst. extra	
4 galls	20 litres	logwood decoction (see page 5)	
$3^1/_5$ pints	2 litres	quercitron $7^1/_2$° Tw.	
$^4/_5$ pints	0,5 litres	nitrate of iron 91° Tw.	
60 lbs	30 kg	potato flour	

Finished three times on both sides and dried each time on drying cylinders; then sprinkled, allowed to lie for a night and mangled 4—5 times. The finishing preparation is coloured with logwood and bichrome.

The bookbinding Calicoes are manufactured in the manner described on page 122 vol. II. The goods used for this purpose must be even and free from faults such as knots. The selvedges must also not be too thick. Horace Koechlin has published a series of recipes for the manufacture of bookbinding Calicoes, from which we select the following:

Brown.

$3^1/_5$ lbs	1,6 kg	Claret Red R	diluted to 125 litres and boiled.
$1^1/_5$ lbs	0,6 kg	Scarlet 3R	
36 lbs	18 kg	Alumina hydrate paste	
8 lbs	4 kg	Aniline Black Lake	
36 lbs	18 kg	white starch	

Crimson.

$4^4/_5$ oz	0,15 kg	Magenta small cryst.	diluted to 125 litres and boiled.
$5^3/_5$ oz	0,175 kg	Rosazeine 4G	
36 lbs	18 kg	Alumina hydrate paste	
36 lbs	18 kg	white starch	

Blue.

18 lbs	9 kg	zinc white	diluted to 125 litres and boiled.
$13\,^{1}/_{5}$ lbs	6,6 kg	Guignet Green	
12 lbs	6 kg	Ultramarine	
6 lbs	3 kg	Aniline Black Lake	
36 lbs	18 kg	starch	

To the category of bookbinding articles belongs also the so-called Pergamoid. It is produced by treating the dyed cotton fabric with celluloid in Azetone or Amylacetate, or nitrocelluloid in alcohol. The Finish is thickened with mineral colours and oil. The goods are passed through a finishing machine with colour box attached and are then conducted through a hot air drying machine. These operations are several times repeated, according to the nature of the fabric. Calandering and embossing are the final operations of this manufacture.

C. RAISED COTTON GOODS.

Melton, Repp, Flannel, Fustian.

Raised Cotton goods (compare page 27 and 48) are used for drapery and decoration purposes as well as for garments. These goods are dyed either on the jigger or in the winch. In the latter case it is necessary to observe the precautions described on page 100 vol. II. In order to impart the fine clothlike handle and gloss to Meltons, they are crabbed and steamed before dyeing. When dyed, the goods are passed through a solution of vegetable glue on a padding machine, then dried on the felt calander and finally tentered.

Flannels and Fustians are finished with wheat starch or dextrine, usually with an addition of softening ingredients, such as softening, glycerine etc., then dried on the tentering frame and finished on the decatizing cylinder.

D. MOLESKIN, IMITATION LEATHER.

These heavy cotton cloths are finished on one side after dyeing; for this purpose a double cylinder finishing machine is used, whose lower oaken cylinder of about 20 inches diameter dips in the finish. The upper wooden cylinder of about 12 inches diameter is covered with cotton cloth. The goods pass between the two cylinders, and are thereby finished on one side. The success of the operation depends on an accurate distribution of pressure, which must be regulated according to the various strengths of the fabrics. The finish differs for shorn and unshorn goods. (Imitation Leather).

1. Finish for Unshorn Goods.

30 lbs	15 kg dextrine	boiled for 15 minutes in an open vessel.
9 galls	45 litres water	

The finish must be clear and when hot must have 6° Tw. It must be kept hot during the finishing process. The goods are first finished on the back, then plated down, then finished on the right side, again plated down, and lastly dried on the cylinder drying machine.

2. Finish for Shorn Goods.

100 lbs	50 kg liquid animal glue 64° Tw	boiled for 15 minutes in an open vessel.
25 lbs	12,5 kg softening	
16 galls	80 litres water	

The finishing preparation is reduced to 6—9° Tw, according to the nature of the fabric. The goods are first finished on the back, then plated down, then finished on the right side, again plated down, and finally dried on the cylinder.

E. LIGHT TAILORING CLOTHS, UMBRELLA CLOTHS, ITALIANS.

These articles (compare page 31 and 33), are generally crabbed and steamed before dyeing, in order to give the finished cloth a close surface. They are dyed on the jigger or on the padding machine; and when dried (which operation is usually carried out on the tentering machines), are finished only slightly or not at all. Plain cloths which are to receive a silk finish, must not be finished with any preparation containing fat, as fatty substances will easily clog the fine engraving of the calander rollers.

F. HEAVY TAILORING CLOTHS.

These goods, used as Imitation Worsteds for Coatings and Trouserings, are dyed with both Dianil- and Thiogene dyestuffs. They are dyed on the jigger and dried after dyeing on the cylinder, or still better in the hotflue or by hanging.

When dyed, the goods are passed on a finishing or padding machine through a diluted solution of Turkey red oil and Marseilles soap, in such a manner that the cloth takes up about

2 % Turkey red oil
0,25 % Marseilles soap

of its own weight. An addition of 2—3 % crystallized Glauber's salt will give the cloth a fuller handle. It is then best dried in the hotflue or by hanging, and calandered under moderate pressure after cooling, by passing it through steel-, paper- and steel rollers, and plating it down, instead of rolling it up. The gloss produced hereby is removed by passing over a steaming table. From there the goods are rolled up and left in that state for several hours.

G. CORDUROY AND VELVET.

Corduroy is generally dyed on the winch with mechanical motion, but in case any aftertreatment is required, and if Thiogene Colours are used, then the process is carried out on the jigger. During this operation care must be taken that the goods run evenly and without creases.

Velvets are mostly dyed on the jigger; for finer qualities the jigger is worked by hand, which enables the passage of the cloth to be better regulated.

After dyeing, the goods are washed either on the winch or on the jigger itself. The moisture can be removed either by the full width hydroextractor or draining machines. For drying the cylinder drying machine, less frequently the tentering machine, is used.

When cooled, the goods are aftertreated on steaming-, brushing-, and raising machines, which regulate the pile of the fabrics.

Corduroy and Velvet are finished on the back, by passing them by means of guide rollers over a wooden cylinder which dips in the finishing trough.

The superfluous finish is removed from the fabric by doctors. Directly after finishing, the goods are dried, Corduroy on the cylinder, Velvet on the tentering frame.

Finish for Corduroy.

200 lbs	100	kg glue gelatine 50%	boiled for an hour in an open vessel.
240 lbs	120	kg softening	
18 galls	90	litres water	
10 lbs	5	kg bone fat	
4/5 pint	0,5	litres turpentine	

This mixture is diluted to 2—5° Tw, according to the desired finished effect.

Finish for Velvet.

40 lbs	20	kg glue gelatine 50%	boiled for 15 minutes in an open vessel.
5 lbs	2,5	kg wheat starch	
1/2 lbs	0,25	kg olive oil	
6 lbs	3	kg Glauber's salt cryst.	
40—80 galls	2—400	litres water	
4/25 pint	0,1	litre turpentine	

Note. Black, darkblue and darkgreen Velvets, more rarely Corduroys, are frequently brushed over with a fine oil colour before finishing, which embellishes and deepens the shades. Two-colour effects can also be produced in the same manner. These oil colours are laid on either by means of finely engraved rollers or specially constructed brushing machines, and immediately spread over most finely by brushing lengthways and across.

Cotton Velvets are also brightened after being finished. This is done by washing, smoothing, brushing and shearing, all which operations are performed on special machines.

◆

H. HOSIERY.

Hosiery goods are manufactured either in the piece on round knitting machines, or as complete stockings. The piece goods are knitted from dyed as well as undyed yarn, and then dyed in the piece. The dyeing operation of these very elastic fabrics which easily stretch out of shape can only be performed on the winch without any tension.

Before dyeing, the goods are boiled with about 2% calc. soda with the addition of a little soap, washed, and then dyed. As they are particularly required to resist washing and perspiration, it is necessary to use
for Black: Dianil Black ES diazotised and developed with Phenylendiamine; or Thiogene Black M liquid, BB liquid, 5B conc.;
for Darkblue: Dianil Black ES diazotised and developed with β-Naphthol;
for Leather Colours: Thiogene Brown- and Thiogene Orange brands.

For inferior qualities the Dianil Colours are used in direct dyeing; e. g. for Black: Patent Dianil Black FF conc. After dyeing the goods are tinted with Methylene Blue BB in a soap bath, and softened in a weak bath of acetic acid.

Ready made Stockings are dyed on the winch like yarns. The goods are worked with sticks during the dyeing operation. Stockings can also be dyed on mechanical dyeing apparatus of the packing system.

◆

I. TENT CANVAS, BAGGINGS etc.

This category, throughout of heavy qualities, comprises tent- and sail-cloths, baggings, shoe canvas, knapsack cloths, materials for waggon covers, tarpaulins etc.

Owing to the difficulty in dyeing these goods in the piece, they are usually woven from dyed yarns. Only such goods as need not be dyed through, and the lighter cloths, e. g. Khaki Twills, are dyed on the jigger.

As the colours must be fast enough to resist all effects of weather, the Thiogene Colours aftertreated with metal salts are chiefly to be considered for brown, khaki, field-grey and similar shades, and, indeed, no other groups of colours ensure the same degree of fastness.

After dyeing, these goods are either slightly calandered or mangled, or finished and waterproofed.

Waterproof Impregnation.

This operation can be carried out in two ways. By the first method the goods are so prepared that, while they repel the water, the pores between the threads remain open. This is called the porous waterproof impregnation. By the second method the goods are impregnated with a water repelling layer in such a way as to close the pores as well. Whereas with the former operation no increase of weight (or only an insignificant one) takes place, the latter causes an increase, often up to 20%, and at the same time alters the handle of the goods.

For both methods of impregnation there exist a great number of directions, partly protected by patents.

For the Production of Porous Waterproof Impregnations melted or dissolved organic products are used, such as wax, paraffin, ceresine etc. These substances are dissolved in very volatile solvents, such as benzine, petroleum ether, and others, or in slightly volatile solvents, such as aniline, nitrobenzole, o-Toluidine, Chloraniline and similar substances. The former method is rather dangerous, on account of the inflammability of the solvents employed; their application, however, is very simple, as it is already sufficient, in order to finish the goods by removing the solvent, to dry them for a short time on the cylinder or tentering frame.

The operation with the slightly volatile solvents is safer. The impregnating liquid is brought upon the cloth in the form of a fine spray by means of a spraying apparatus, or with rotating rollers, and the solvent is removed by steaming. —

For the Production of Waterproof Impregnations which close up the pores of the fabric the property of copper-oxide-ammonia to dissolve celluloid, can be utilized. Copper-oxide-ammonia is obtained by the reaction of ammonia upon copper chips under admission of air. It can also be obtained by precipitating a solution of copper sulphate and caustic soda, and dissolving the precipitate in ammonia. The precipitation must take place at a temperature below 68° F, and the precipitate must be thoroughly washed and pressed out. For a solution, ammonia of the specific weight of 0,93 is used.

The goods are passed on the padding machine, according to quality, through solutions of 7° to 12° Tw, and dried immediately after in a well ventilated hot air drying machine. Undyed fabrics get thereby a blueish green shade of great brilliancy, which, in practice, is called metallic green. This colour, produced upon dyed fabrics, naturally modifies the shade, and it is therefore possible to produce in this manner the most diverse colourings. By passing the goods through diluted acid which dissolves the precipitated copper, but retains the brilliancy, other colour effects can be produced. —

The most usual method for the production of waterproof goods, especially applied to Tent Canvas, consists in filling the fabrics with oleate metal oxides, particularly with alumina oleate. The goods are impregnated with acetate of alumina on the padding machine, then slowly dried, and hung at a temperature not exceeding 104° F. The alumina mordant loses thereby its solubility whilst acetic acid is liberated. The goods are then passed hot, through a soap solution, in which fats, wax, resins etc., have been dissolved, then dried, again hung, and finally mangled or calandered.

1. Mordanting.

The goods are passed at 113° F (indirect heating) on the padding machine three times through acetate of alumina of 11° Tw, and dried by hanging at about 104° F within at least 12 hours.

2. Soaping.

In 60 galls (300 litres) of solution:

40 lbs	20 kg	resinous soap
30 lbs	15 kg	stearine
8 lbs	4 kg	paraffin
4 lbs	2 kg	Japan wax
10 lbs	5 kg	linseed oil varnish.

The goods are passed twice through the solution on a padding machine at 140° F, and dried by hanging.

According to requirement the goods are afterwards glued, by being passed through a solution of 10 kg carpenter's glue in 300 litres water, and finally mangled.

K. MULTICOLOURED FABRICS.

In view of the diversity of the demands made upon the coloured yarns for multicoloured fabrics, only a brief description of the chief features of dyeing, sizing and finishing can be given.

For those multicoloured fabrics which are subjected to frequent washing, such as Shirtings, Apron cloths, washable dress materials, Table cloths etc., the colours fastest to washing must be used. These are — besides Indigo and Alizarine dyestuffs, — principally the Thiogene colours, and next to these Para Red.

For Blouses and Dress Stuffs which are not so frequently washed, besides those named above, the fastest basic and Dianil Colours are used as they are indispensable for brighter shades.

Similar demands for fastness are made upon articles for men's wear.

In dyeing corset materials, special regard must be had to employ colours fast to perspiration. Fastness to light and washing being in this case a secondary consideration. Particular fastness to light and in part also to weather is requisite for Marquee-, Blind- and Curtain cloths. For these goods and also for Furniture cloths, Indigo and Alizarine Colours are used, as also the Dianil- and Thiogene Colours aftertreated with metal salts.

The yarns for Mattress Coverings, if required perfectly fast, are dyed with Alizarine and Thiogene colours. As substitutes for Turkey Red both Azophor Red and Dianil Fast Scarlet (fast to acids), and for the cheapest qualities Dianil Red, are used. The shades formerly produced upon these goods with Catechu and wood colours, are now frequently obtained with Dianil colours, besides Thiogene Colours, the brighter shades with basic dyestuffs.

Similar demands are made upon Beddings, for which, however, besides the selection of dyestuffs, their fastness to washing has also to be considered.

The object of Sizing the yarns, especially the warp yarns, is to fit the thread for being worked in the looms. This is done by finishing them with starch and weighting substances, fats etc., which give the thread the requisite smoothness, by making the small fibres and fluff stick to it, and at the same time improve the handle and often the weight of the material. The yarns are sized either by hand in the hank, or on specially constructed machines (warp sizing machines). If on these machines white and coloured yarns are sized together, it is necessary to choose a dye which, in the hot size, does not bleed into the white.

1. Size for Yarn in the Cistern.

30 galls 150 litres
(for 300 lbs yarn).

10 lbs	5 kg	potato flour	boiled for 15 minutes in an open vessel. In sizing the liquid is diluted with water as required.
10 lbs	5 kg	maize starch	
2 lbs	1 kg	chloride of magnesia	
3 lbs	1,5 kg	Japan wax	
30 galls	150 litres	water	

2. Size for Sizing Machine.

240 galls 1200 litres
(for about 5000 lbs yarn).

300 lbs	150 kg	potato flour	boiled for 15 minutes in an open vessel. In sizing the liquid is diluted with water to half its strength.
200 lbs	100 kg	wheat flour	
150 lbs	75 kg	China clay	
100 lbs	50 kg	bitter salt	
50 lbs	25 kg	chloride of magnesia	

The Finishing of Multicoloured Fabrics is mostly limited to slight calandering or mangling, inasmuch as the sizing usually suffices to give the necessary handle.

For a soft woolly handle a weak soap bath at about 104° F is given. The yarn is squeezed out and dried without being previously rinsed. A cheap finish for common qualities of bedding and other multicoloured fabrics can be produced with bitter salt and dextrine. These bitter salt finishings are chiefly made use of in order to give the goods a thick, full handle and increased weight.

According to the class of goods this finish is used in strength of 8—33° Tw.

Standard Finish:

In 30 galls 150 litres water

50 lbs	25 kg	dextrine	about 33° Tw.
60 lbs	30 kg	bitter salt	
4 lbs	2 kg	Monopole soap	

The goods are passed on a padding machine through the correspondingly diluted finish, then dried on the tentering frame, and sprinkled as required.

Recipes for page 17.
(Compare page 1—7.)

1.

Double Cloth.

3 % Patent Dianil Black FFC conc. pat
old bath.

2.

Glacé Twill.

3.25 % Patent Dianil Black FFC conc pat.
old bath.

3.

Milanese.

8 % Thiogene Black BRR conc.

4.

Jaconet.

3.25 % Patent Dianil Black FFC conc. pat.

5.

Stripes.

3 % Patent Dianil Black FFC conc. pat

6.

Macco Calico.

3 % Patent Dianil Black FFC conc. pat.

7.

Stripes.

2.5 % Dianil Brown D.

8.

Stripes.

2,4 % Dianil Darkblue R.
1,2 % Dianil Blue 2 R.

9.

Embossed.

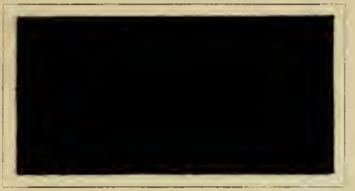
2,36 % Dianil Blue 2 R.
0,44 % Patent Dianil Black FB pat.

10.

Stripes.

2.5 % Dianil Brown D.
1 % Dianil Brown 3 GO.

LININGS.



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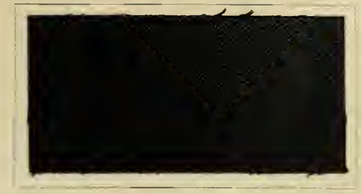

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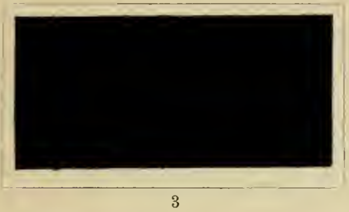

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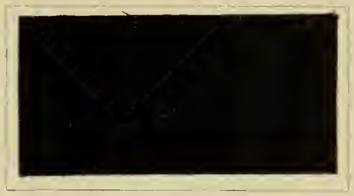

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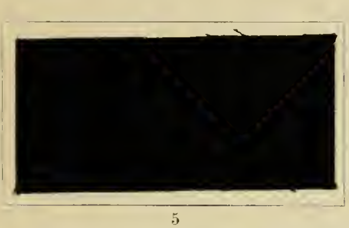

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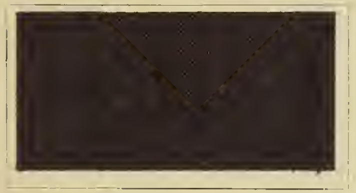

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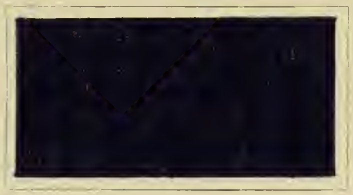

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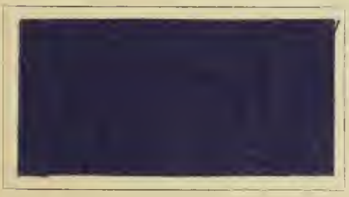

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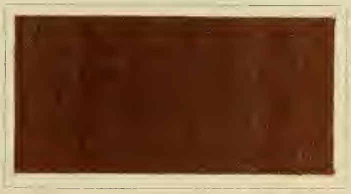


10

Recipes for page 19.

(Compare page 1—6).

1.

Satin Twill.

0,25 % Oxydianil Yellow O pat.
0,25 % Dianil Fast Brown B
0,05 % Patent Dianil Black FB pat.

2.

Weft Satin.

0,22 % Oxydianil Yellow O
0,27 % Dianil Fast Brown B
0,17 % Patent Dianil Black FB pat.

3.

Milanese.

0,43 % Patent Dianil Black FB pat.

4.

Maceo Milanese.

0,96 % Patent Dianil Black FB pat.
0,07 % Dianil Brown B

5.

Satin Twill.

0,4 % Patent Dianil Black FB pat.
0,25 % Dianil Black CR

6.

Milanese.

0,77 % Patent Dianil Black FB pat.
0,23 % Dianil Brown 3 GO.

7.

Embossed.

0,45 % Dianil Blue H 6 G

8.

Rustle Lining.

2,5 % Dianil Brown 3 GO.

9.

Rustle Lining

(figured).

4 % Dianil Claret Red G

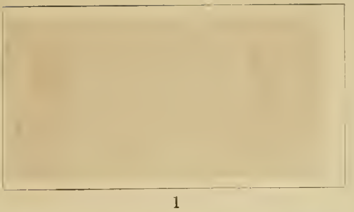
10.

Taffeta.

1,8 % Dianil Green B
0,7 % Dianil Yellow 3 G

The shades on linings were dyed on single pieces in the jigger. The percentages indicated therefore refer to a weak bath and the dyestuff remaining in the liquid is not taken into consideration.

LININGS.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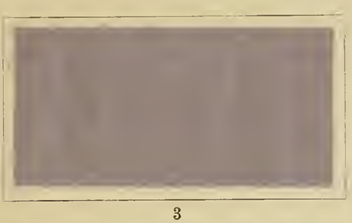
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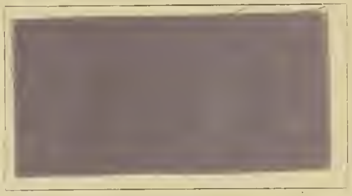
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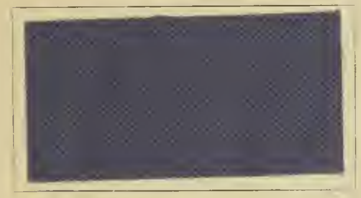
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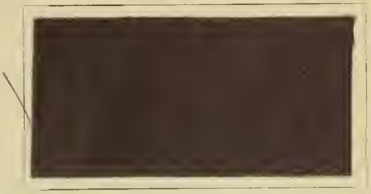
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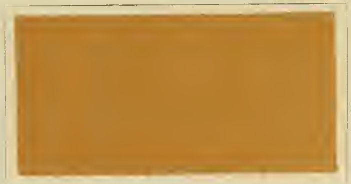
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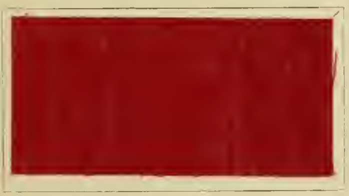
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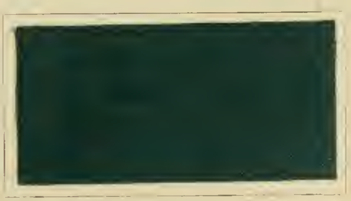
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Recipes for page 21.
(Compare page 1—6).

1.

Bunting.

1,33 % Aurophenine O

2.

Bunting.

12 % Thiogene Green GL extra

3.

Damask.

4 % Brilliant Croceïne B

4.

Jaconet.

0,22 % Dianil Pink BD

5.

Jaconet.

2 % Dianil Chrome Brown R.

6.

Weft Satin.

0,46 % Patent Dianil Black FB pat.
0,03 % Dianil Black CR

7.

Pocketing.

0,4 % Patent Dianil Black FB pat.

8.

Augusta Satin.

0,14 % Oxydianil Yellow O
0,10 % Dianil Fast Brown B
0,03 % Patent Dianil Black FB pat.

9.

Augusta Satin.

Paranitraniline Red.

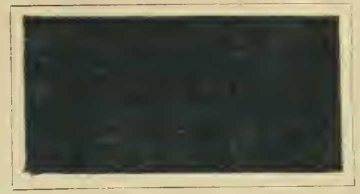
10.

Augusta Satin.

2 % Dianil Azurine G
(aftertreated with copper).

LININGS.

1



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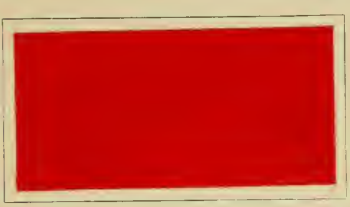

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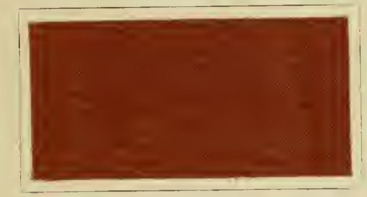

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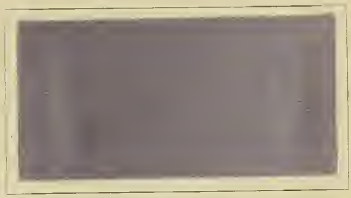

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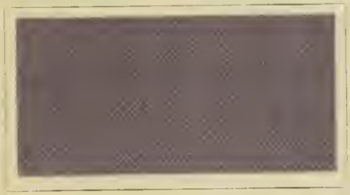

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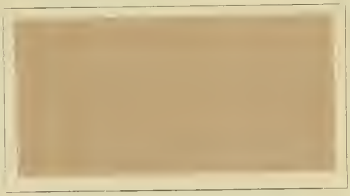

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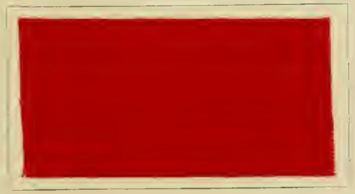

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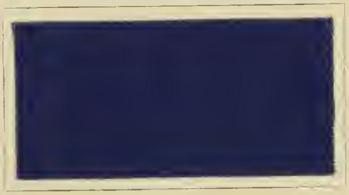


10

Recipes for page 23.

(Compare page 1—6.)

1.

Pocketing.

0.45 % Oxydianil Yellow O
0,15 % Dianil Fast Brown B

2.

Panama Cloth.

0,32 % Oxydianil Yellow O
0,08 % Dianil Fast Brown B
0,06 % Patent Dianil Black FB pat.

3.

Twill Pocketing.

1,8 % Thiogene Khaki O

4.

Moleskin Pocketing.

0,33 % Oxydianil Yellow O
0,07 % Patent Dianil Black FB pat.
0,09 % Dianil Brown B

5.

Twill Pocketing.

3,2 % Thiogene Khaki O.

6.

Twill.

1,5 % Dianil Brown B
1,5 % Dianil Brown 3GO.

7.

Repp.

1 % Dianil Azurine G
(aftertreated with copper).

8.

Repp.

7,25 % Thiogene Darkblue BTL

9.

Heavy Cotton Cloth.

6 % Thiogene Blue B
(in a running bath).
Developed by airing.

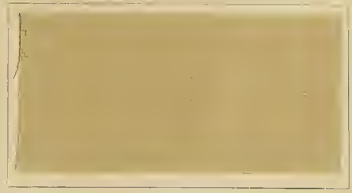
10.

Curtain Twill.

1 % Methylene Green extra yellow
0,2 % Methylene Yellow H
3 % Acetic Acid
on Tannin-Tartar emetic.

LININGS.

1



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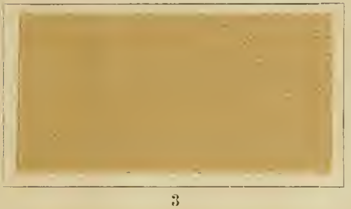

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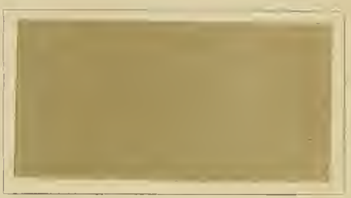

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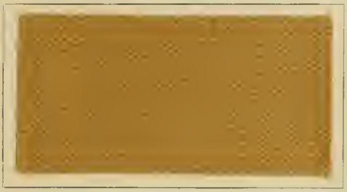

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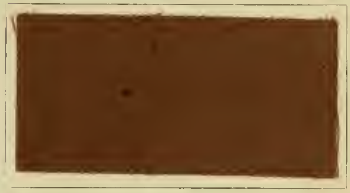

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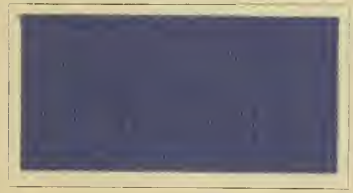

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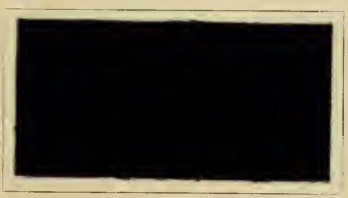


9

10

Recipes for page 25.

(Compare page 6).

Dyed in the cistern.

1.

0,1 % Dianil Yellow 3 G
1 % Turkey red oil
5 % common salt.

2.

0,01 % Oxydianil Yellow O
1 % Turkey red oil
1 % common salt.

3.

0,04 % Dianil Red 4 B
0,02 % Dianil Orange G
1 % Turkey red oil
5 % common salt.

4.

0,02 % Dianil Blue 2 R
1 % Turkey red oil
5 % common salt.

5.

0,025 % Methylene Green extra yellow conc.
0,025 % Methylene Yellow H
5 % acetic acid
1 % tannin
aftertreated in the rinsing bath with
0,5 % Tartar emetic.

6.

0,1 % Toluylene Orange R
1 % Turkey red oil
5 % common salt.

7.

0,05 % Dianil Pink BD
1 % Turkey red oil
5 % common salt.

8.

0,035 % Patent Dianil Black FF conc. pat.
0,011 % Aurophenine O
1 % Turkey red oil
5 % common salt.

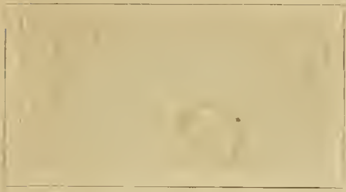
9.

0,05 % Methylene Blue BB conc.
5 % acetic acid
1 % tannin
aftertreated in the rinsing bath with
0,5 % Tartar emetic.

10.

0,05 % Methylene Heliotrope O
5 % acetic acid
1 % tannin
aftertreated in the rinsing bath with
0,5 % Tartar emetic.

BALLDRESS COLOURS ON MERCERISED COTTON CLOTHS.



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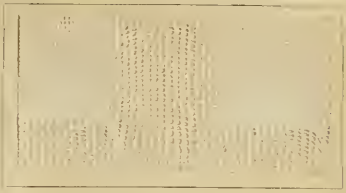

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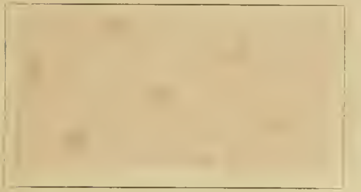

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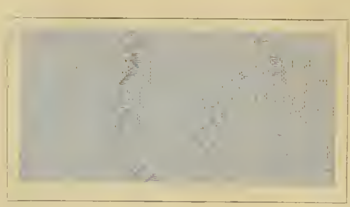

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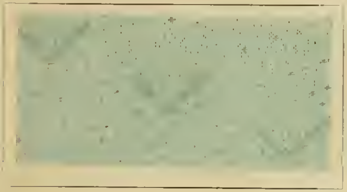

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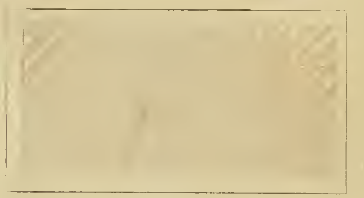

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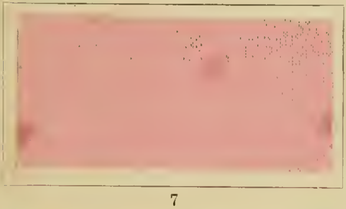

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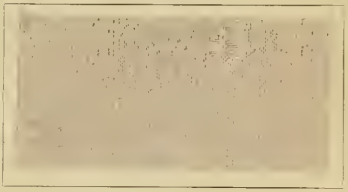

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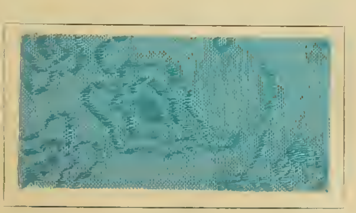

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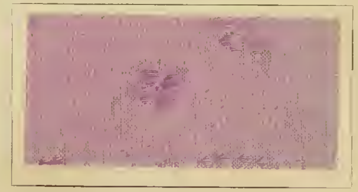

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Recipes for page 27.
(Compare page 7 and 8.)

1.

Satin.

1,5 % Aurophenine O
0,1 % Dianil Brown 3 GO.

2.

Satin.

2 % Aurophenine O
0,1 % Dianil Blue HG.

3.

Melton.

1,75 % Aurophenine O
0,3 % Dianil Fast Brown B.

4.

Moleskin.

2,5 % Aurophenine O
0,3 % Patent Dianil Black FF conc. pat.

5.

Melton.

3 % Dianil Fast Red PH
2 % Dianil Brown 3 GO.

6.

Repp.

1,5 % Dianil Red 4 B
1,5 % Dianil Claret Red. G.

7.

Moleskin.

0,5 % Thiogene Brown GC
0,125 % Thiogene Brown GR
0,125 % Thiogene Black MM conc.

8.

Moleskin.

6 % Thiogene Green GG
8 % Thiogene Green GL extra pat.

9.

Bookbinding Calico.

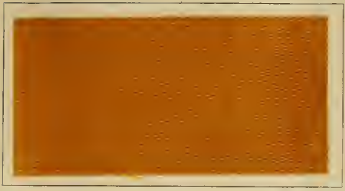
Dyed with
Scarlet 3 RL.

10.

Bookbinding Calico.

Dyed with
Dianil Darkblue R and
Methyl Violet BB.

DECORATION AND BOOKBINDING.



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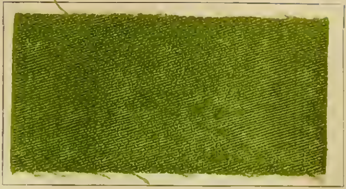

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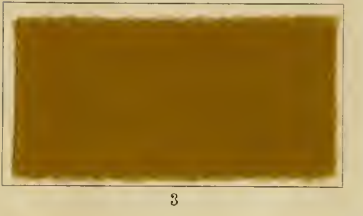

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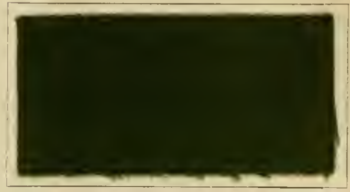

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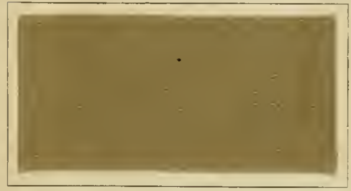

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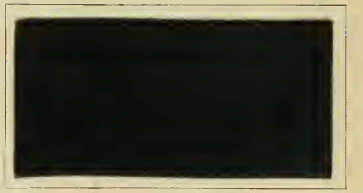

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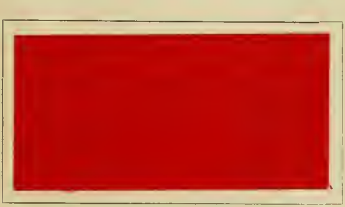

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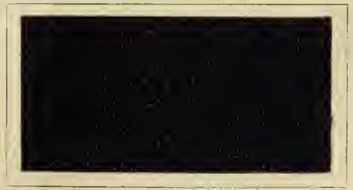


10

Recipes for page 29.

1.

1 lbs		60 grs	Naphthol Yellow S
2 lbs	4 oz	200 grs	alcohol
13 lbs		800 grs	water.

2.

1 lbs	10 oz	100 grs	Methyl Violet B
3 lbs	4 oz	200 grs	alcohol
13 lbs		800 grs	water.

3.

	11 oz	50 grs	Pure Blue conc.
3 lbs	4 oz	200 grs	alcohol
13 lbs		800 grs	water.

4.

	5½ oz	20 grs	Brilliant Green cryst. extra
1 lbs	10 oz	100 grs	alcohol
14 lbs	8 oz	900 grs	water.

5.

	9½ oz	40 grs	Auramine O
	¾ oz	3 grs	Chrysoidine A cryst.
	2 oz	7 grs	Brilliant Green cryst. extra
1 lbs	10 oz	100 grs	alcohol
14 lbs	8 oz	900 grs	water.

6.

	12 oz	43 grs	Auramine O
	2 oz	7 grs	Brilliant Green cryst. extra
1 lbs	10 oz	100 grs	alcohol
14 lbs	8 oz	900 grs	water.

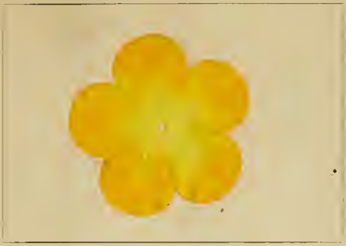
7.

2 lbs	10 oz	160 grs	Eosine extra A conc.
3 lbs	4 oz	200 grs	alcohol
13 lbs		800 grs	water.

8.

	5½ oz	20 grs	Erythrosine A
	2¾ oz	10 grs	Scarlet R
3 lbs	4 oz	200 grs	alcohol
13 lbs		800 grs	water.

ARTIFICIAL FLOWERS.



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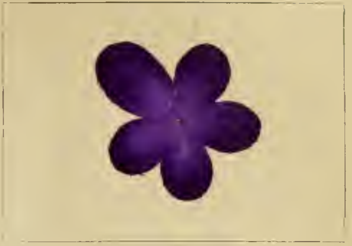

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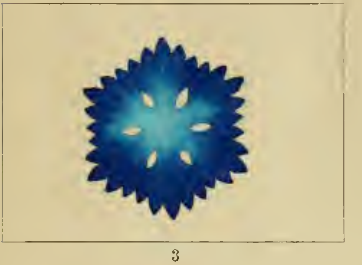

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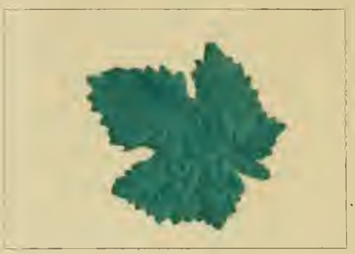

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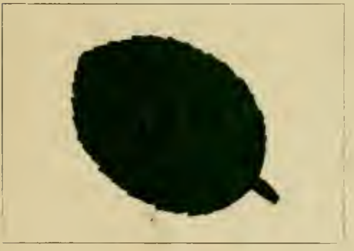

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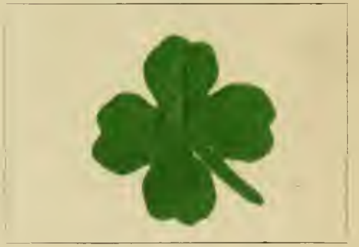

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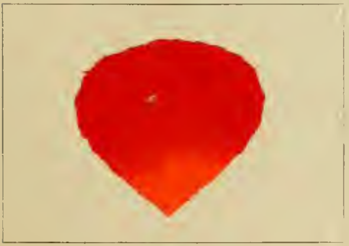

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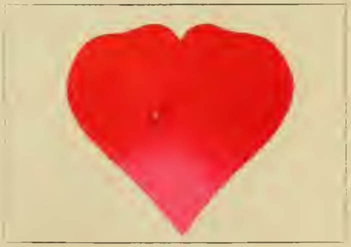


8

Recipes for page 31.
(Compare page 9.)

1.

20 % Thiogene Diamond Black B
30 % Sodium Sulphide cryst.
4 % soda calc.
10 % Glauber's salt
2 % Turkey red oil.

2.

20 % Thiogene Black M liquid pat.
12 % sodium sulphide cryst.
4 % soda calc.
10 % Glauber's salt cryst.
2 % Turkey red oil.

3.

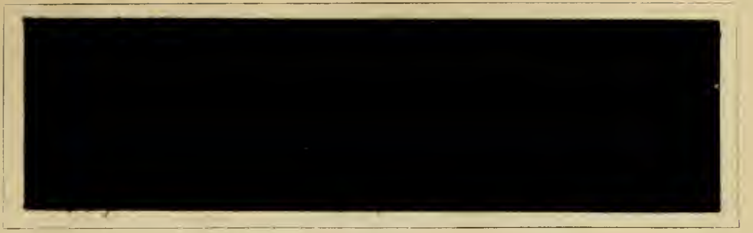
22 % Thiogene Black BB liquid pat.
12 % sodium sulphide
4 % soda calc.
10 % Glauber's salt cryst.
2 % Turkey red oil.

4.

10 % Thiogene Black MM conc.
30 % sodium sulphide cryst.
4 % soda calc.
10 % Glauber's salt. cryst.
2 % Turkey red oil.

First rinsed in water at 140° F with 1 % soda, then washed in cold water. Finally passed on the padding machine with $1^1/_2$ oz. soap per 10 gallons, squeezed out and dried.

BLACK DRESS GOODS.



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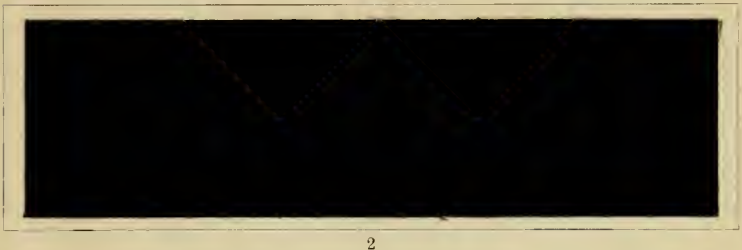

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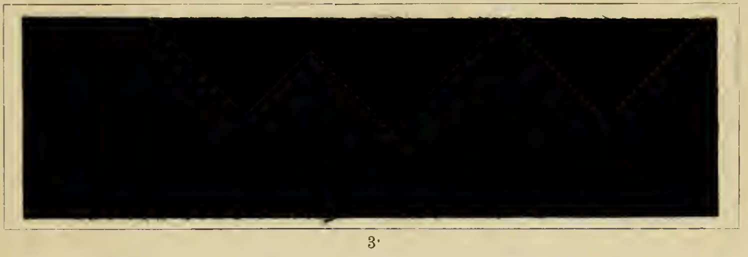

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Recipes for page 33.
(Compare page 9.)

1.
Umbrella Cloth.

Diphenyl Black pat.
(For directions for dyeing see vol. I, page 207.)

2.
Italian Cloth.

5 %	Thiogene Brown S
1,5 %	Thiogene Brown GC
0,25 %	Thiogene Black MM conc.
10 %	sodium sulphide cryst.
3 %	soda calc.
5 %	Glauber's salt cryst.
2 %	Turkey red oil.

3.
Italian Cloth.

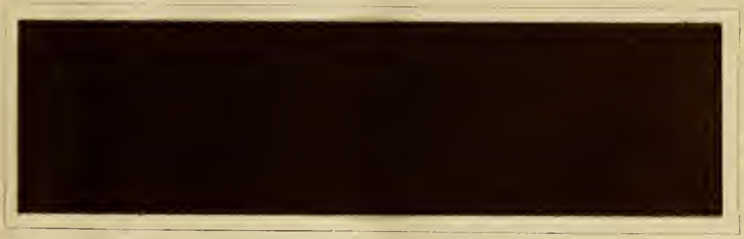
5 %	Thiogene Black M liquid pat.
5 %	sodium sulphide cryst.
2,5 %	soda calc.
2 %	Turkey red oil.

4.
Italian Cloth.

20 %	Thiogene Black M liquid pat.
10 %	sodium sulphide cryst.
4 %	soda calc.
10 %	Glauber's salt cryst.
2 %	Turkey red oil.

UMBRELLA CLOTH AND COTTON-ZANELLA.

1



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Recipes for page 35.

(Compare page 9.)

1.

1 % Oxydianil Yellow O
0.08 % Dianil Brown 3GO
0,05 % Dianil Blue B

2.

0,4 % Patent Dianil Black FF conc.
0,04 % Dianil Darkgreen B.

3.

0,3 % Oxydianil Yellow O
0,2 % Dianil Brown BD
0,1 % Patent Dianil Black FF conc.

4.

1,6 % Oxydianil Yellow O
0,6 % Dianil Brown 3GO
0,5 % Dianil Brown BD
0,05 % Dianil Black CR.

5.

3,25 % Dianil Brown BD
0,75 % Oxydianil Yellow O
0,15 % Dianil Black CR
0,10 % Dianil Fast Scarlet 8BS.

6.

0,6 % Oxydianil Yellow O
0,4 % Dianil Green G
0,2 % Dianil Brown MH.

7.

1,3 % Patent Dianil Black FF conc.
1 % Dianil Darkgreen B
0,5 % Aurophenine O.

8.

3 % Dianil Blue BX
1,5 % Patent Dianil Black FF conc.

9.

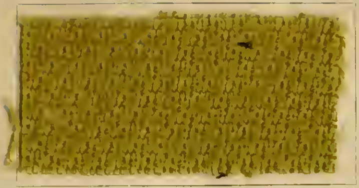
4 % Dianil Brown 3R
1,25 % Patent Dianil Black FFC conc.

10.

3,5 % Patent Dianil Black FFC conc.

The goods are entered dry into the bath on the jigger, containing about 1 % soda and 2 % Turkey red oil, after that the colour solution is added at both ends, then are added 5—10 % Glauber's salt, and the goods are dyed at the boil in 8—10 portions in the threefold quantity of liquid.

GOODS FOR WORKMEN'S CLOTHES.



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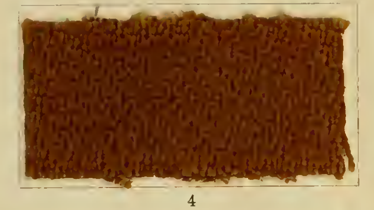

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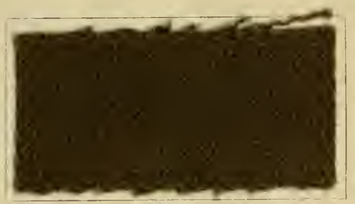

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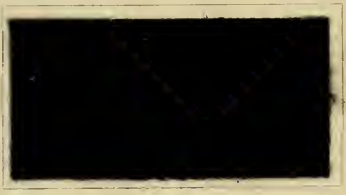

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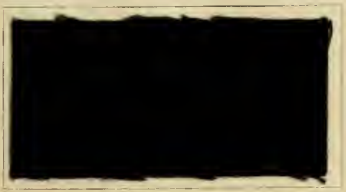

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Recipes for page 37.

(Compare page 9.)

1.

6 % Thiogene Green GG
4 % Thiogene Brown GR
0,6 % Thiogene Black MM conc.

2.

10 % Melanogene Blue B
aftertreated with
1,25 % cadmium sulphate
0,5 % nickel sulphate
2,5 % acetic acid.

3.

1 % Thiogene Brown GC
1 % Thiogene Brown GR
0,4 % Thiogene Black MM conc.

4.

10 % Thiogene Brown GR
0,25 % Thiogene Black MM conc.

5.

1 % Thiogene Black BB conc.

6.

4 % Thiogene Darkblue BTL
4 % Thiogene Blue B
developed by airing.

7.

10 % Thiogene Catechu R
4 % Thiogene Brown GRR
1,5 % Thiogene Black MM conc.

8.

7 % Thiogene Brown GRR
1,5 % Thiogene Black MM conc.

9.

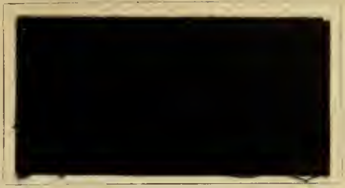
1 % Thiogene Brown GC
0,25 % Thiogene Black MM conc.

10.

20 % Thiogene Black BRR liquid.

GOODS FOR WORKMEN'S CLOTHES.

1



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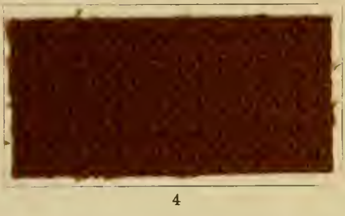

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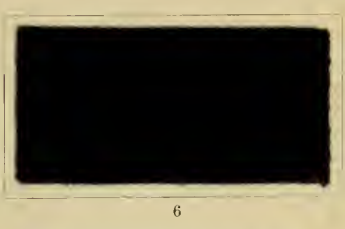

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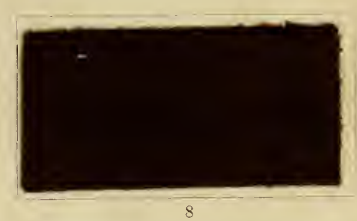

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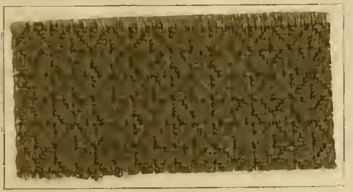

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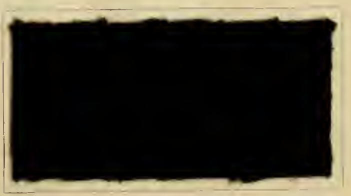


10

Recipes for page 39.

1.

Warp: Aniline Black
Weft: 8 % Thiogene Black MM conc. (running bath).

2.

Black: 12 % Thiogene Black BRR liquid (dyed on the Obermaier, running bath).
Darkblue: 6 % Melanogene Blue B
5,5 % Melanogene T, running bath, fixed at 104° F
1,25 % cadmium sulphate
2 % acetic acid.
Red: 5 % Primuline O, diazotized and developed with β-Naphtol.

3.

Black: 12 % Thiogene Black BRR liquid (dyed on the Obermaier, running bath).
Brown: 4 % Thiogene Brown GR
3 % Thiogene Brown S (running bath, topped with 0,1 % Magenta small crystals).
Pale Blue: 1 % Methylene Blue R conc., upon tannin-Tartar emetic.
Red: Alizarine Red (New Red).

4.

Warp: Aniline Black.
Weft: 8 % Thiogene Black MM conc. (running bath).
Brown: 6 % Thiogene Orange O
0,5 % Thiogene Brown GR
running bath, aftertreated with
3 % copper vitriol and
3 % acetic acid.

5.

Black: 12 % Thiogene Black BRR liquid (running bath).
Brown: 4 % Thiogene Brown GR
3 % Thiogene Brown S (running bath) topped with
0,1 % Magenta, small crystals.

6.

Warp: Aniline Black.
Weft: 8 % Thiogene Black MM conc. (running bath).
Red: Alizarine Red (New Red).

7.

Warp: Aniline Black.
Weft: 8 % Thiogene Black MM conc. (running bath).
Blue: 2,25 % Alizarine Blue SBR, upon Chrome Mordant.
Cream: 0,05 % Oxydianil Yellow O.

8.

Warp: Aniline Black.
Weft: 8 % Thiogene Black MM conc
Orange: 1 % Dianil Orange G
1 % Dianil Direct Yellow S.

9.

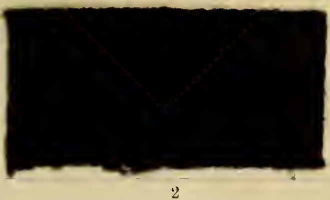
Black: 12 % Thiogene Black BRR liquid (running bath).
Brown: 5,5 % Thiogene Brown S
2 % Thiogene Brown GC (running bath).
Grey: 0,5 % Dianil Black ES.
Orange: 1 % Dianil Orange G
1 % Dianil Direct Yellow S.

10.

Black: 12 % Thiogene Black BRR liquid (running bath).
Brown: 4 % Thiogene Brown GR
3 % Thiogene Brown S (running bath), topped with
0,1 % Magenta small crystals.

MULTI-COLOURED TAILORING CLOTHS.

1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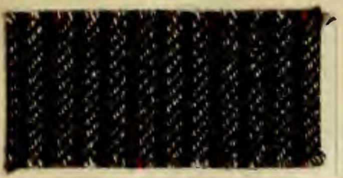
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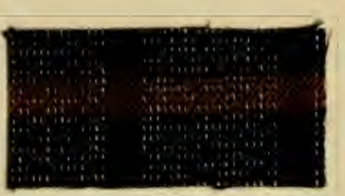
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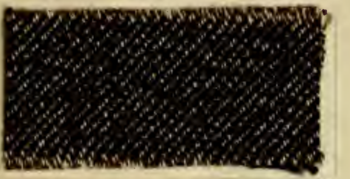
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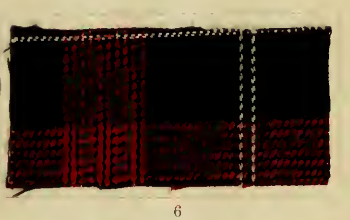
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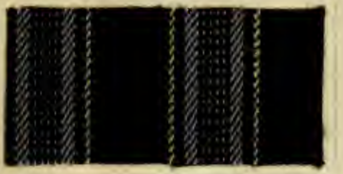
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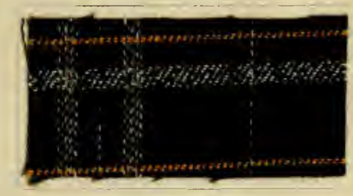
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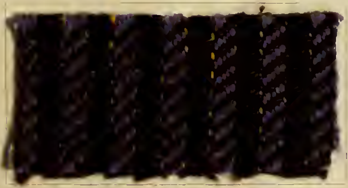
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Recipes for page 41.

(Compare page 9.)

1.

0,5 % Thiogene Brown GC
0,2 % Thiogene Brown GR
0,05 % Thiogene Black MM conc.

2.

0,25 % Thiogene Brown GR
0,25 % Thiogene Black MM conc.

3.

10 % Thiogene Blue B.

4.

4 % Thiogene Brown GC
4 % Thiogene Yellow GG

5.

15 % Thiogene Brown GC
1,5 % Thiogene Black MM conc.

6.

15 % Thiogene Brown GR
0,25 % Thiogene Black MM conc.

7.

2,5 % Dianil Brown 3GO
1 % Aurophenine O
1,5 % Patent Dianil Black FF conc.

8.

2 % Aurophenine O
1,5 % Dianil Black CR
topped with
0,3 % Methylene Yellow H.

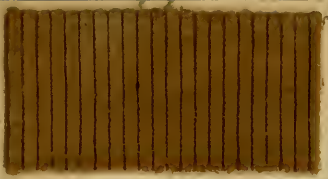
9.

10 % Thiogene Brown GR
5 % Thiogene Brown R
5 % Thiogene Black MM conc.,
topped with
0,1 % Vesuvine 4BG conc, and
2 % alum.

10.

20 % Thiogene Black BB solution.

CORDUROY.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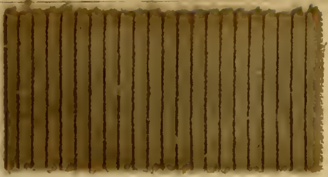

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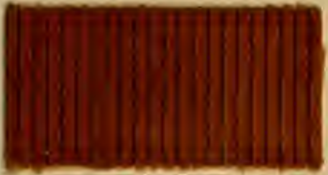
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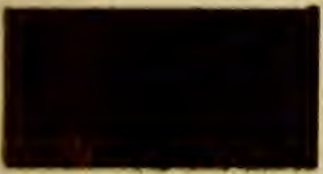
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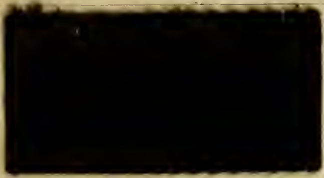
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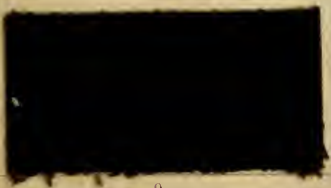
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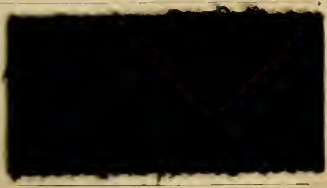
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Recipes for page 43.

(Compare page 9.)

1.

3 % Thiogene Green GL extra.

2.

3 % Rosazeine 4G
3 % acetic acid 12° Tw.,
on tannin-Tartar emetic.
Dyed from cold to 140° F.

3.

1,2 % Magenta small cryst.
1,2 % Vesuvine 4BG conc.
0,05 % Methyl Violet 3B,
on tannin-Tartar emetic.

4.

2 % Methyl Blue for Cotton MLB
0,5 % Methylene Blue R
2 % acetic acid
3 % alum,
on tannin-tin mordant.
Dyed from cold to 104° F.

5.

1,5 % Methylene Yellow H
0,5 % Jute Black O
0,1 % Vesuvine 4BG conc.,
on tannin-Tartar emetic.

6.

4 % Dianil Red 4B,
topped with Paris Blue oil paint.

7.

4 % Dianil Indigo O,
topped with
0,1 % Methylene Blue B,
with Paris Blue oil paint.

8.

2 % Thiogene Brown GC
1,5 % Thiogene Brown S
0,3 % Thiogene Black M conc.

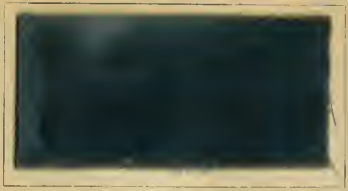
9.

2,5 % Dianil Brown 3GO
1 % Oxydianil Yellow O
0,5 % Dianil Black N,
developed with
2 % Azophor Red PN
1 % sodium acetate,
improved with
0,2 % Vesuvine 4BG conc.

10.

6 % Dianil Black N
(running bath),
topped with Paris Blue oil paint.

VELVET.



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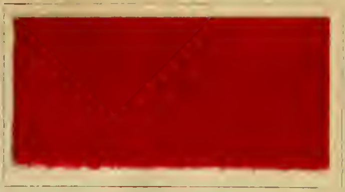

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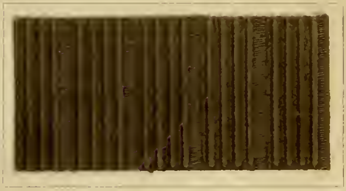

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10

Recipes for page 45.

(Compare page 10.)

1.

1,4 % Oxydianil Yellow O
0,36 % Dianil Orange N.

2.

0,05 % Dianil Darkblue R
0,05 % Dianil Blue G.

3.

0,8 % Dianil Fast Scarlet 8BS.

4.

0,1 % Dianil Darkblue R
0,3 % Oxydianil Yellow O
0,08 % Dianil Fast Brown B.

5.

5 % Primuline O,
diazotized and developed with
1 % β-Naphthol.

6.

4,5 % Dianil Brown 3GO
1,8 % Oxydianil Yellow O
0,3 % Patent Dianil Black FF conc.

7.

1,4 % Oxydianil Yellow O
0,36 % Dianil Orange N

8.

5 % Thiogene Brown G2R
2,5 % Thiogene Orange R
(running bath).

9.

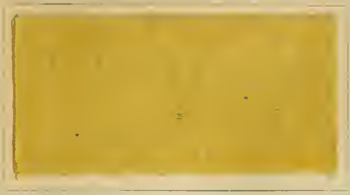
4 % Dianil Darkblue R,
after dyeing rinsed in cold bath with
4 % acetic acid 12° Tw.

10.

5 % Patent Dianil Black FF conc.
After dyeing and rinsing topped with
0,1 % Methylene Blue BB conc., and
3 % Marseilles soap.

The goods were wetted in boiling water, and dyed on the winch.

HOSIERY.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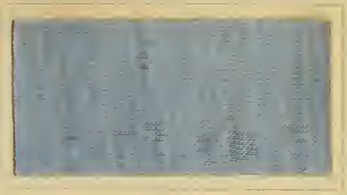
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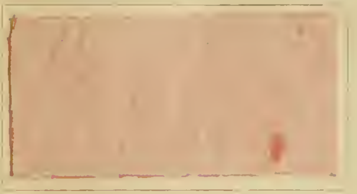
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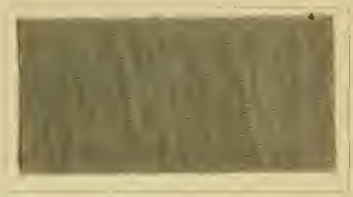
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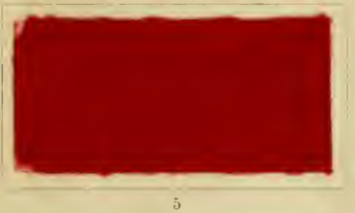
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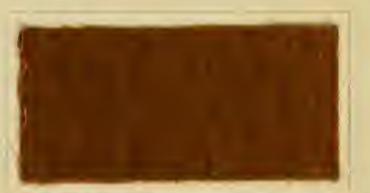
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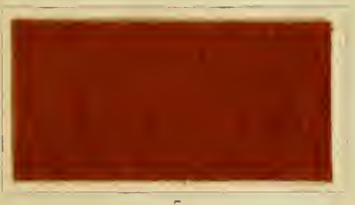
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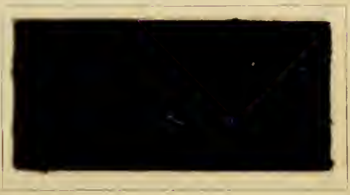
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Recipes for page 47.

1.

Produced from Melange.
Recipe 1, page 29 Vol. II.

2.

Produced from Melange.
Recipe 7, page 29 Vol. II.

3.

Blue: 0,1 % Dianil Blue H6G

4.

Red: 3 % Dianil Red 4B.
After dyeing stripped at 104° F
with 8% soda calc.
Black: 4 % Thiogene Black M liquid
4 % Thiogene Black B2R liquid
(old bath).

5.

Brown: 3% Dianil Japonine G.
Black: as pattern 4.

6.

Black: as pattern 4.

7.

Black: as pattern 4.
Red: as pattern 4.

8.

Black: as pattern 4.
Yellow: 1.5% Oxydianil Yellow G.

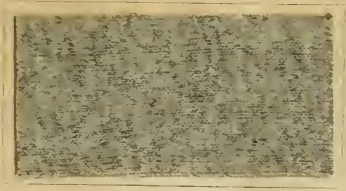
9.

Black: 13 % Thiogene Black B2R liquid
(old bath).
Green: 6 % Thiogene Green GL extra
(old bath),
topped with
0,2 % Methylene Green 2G.

10.

Black: as pattern 9.
Blue: 2 % Dianil Blue H6G,
topped with
0,15 % Methylene Blue BB conc.

MULTICOLOURED HOSIERY.



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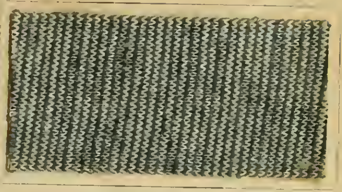

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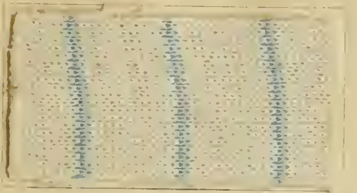

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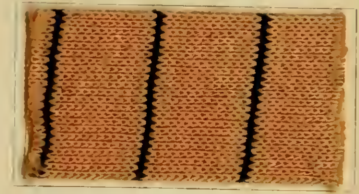

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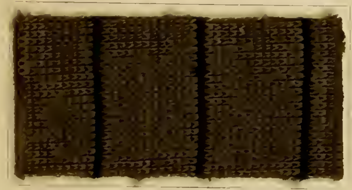

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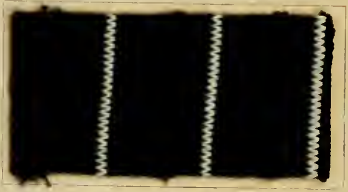

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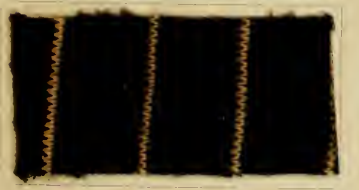

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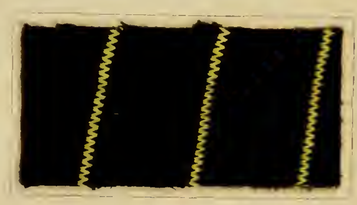

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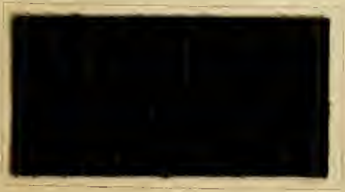

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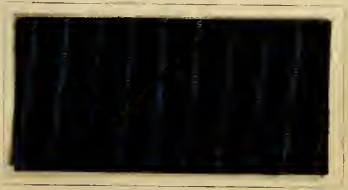


10

Recipes for page 49.

(Compare page 8.)

1.

Warp and Weft Yarns are dyed in the top.
Black: 8 % Thiogene Black B 2R conc.
Brown: 15 % Thiogene Brown GC
3 % Thiogene Brown G.
Blue Jaspé: Recipe 15, page 30 Vol. II.

2.

Warp, **Blue:** Indigo MLB paste 20 %.
Black Print: Logwood.
Blue Print: Alizarine Blue SB powder.
Weft, **Blue:** Indigo.
Red: Alizarine Red No. 1 paste 20 %.
Blue Print: Alizarine Blue SB powder.

3.

Warp and Weft Yarns are dyed in the top.
Warp, **Drab Jaspé:** 5 % Thiogene Orange RR
2,5 % Thiogene Orange RG.
Blue Jaspé: Recipe 15, page 30 Vol. II.
Brown: 15 % Thiogene Brown GC
3 % Thiogene Brown S.
Weft, **Brown:** 9 % Thiogene Brown GC.
Pink Jaspé: Recipe 18, page 30 Vol. II.
Orange Jaspé: Recipe 14, page 30 Vol. II.

4.

Warp and Weft Yarns are dyed in the top.
Brown: 15 % Thiogene Brown GC
3 % Thiogene Brown S.
Blue Jaspé: Recipe 15, page 30 Vol. II.
Drab Jaspé: 5 % Thiogene Orange RR
2.5 % Thiogene Orange RG.

5.

Darkblue: Indigo MLB paste 20 %.
Pale Blue: 0,6 % Methylene Blue R conc.
5 % acetic acid
(on tannin-Tartar emetic).

6.

Red: 2,5 % Alizarine Red 1 B 20 %
steamed and softened.

7.

Dyeing on the jigger.
0,15 % Dianil Black CR
0,06 % Dianil Pink BD
0,01 % Oxydianil Yellow O.

8.

Dyeing on the jigger.
0,25 % Dianil Blue B
0,25 % Dianil Blue G.

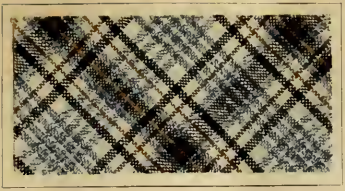
9.

Dyeing on the jigger.
2 % Dianil Red 4 B.

10.

1,6 % Dianil Brown MH
0,6 % Patent Dianil Black FF conc.
0.3 % Oxydianil Yellow O.

BEAVER, SHIRT FLANNEL.



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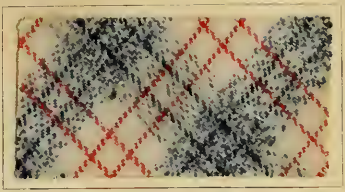

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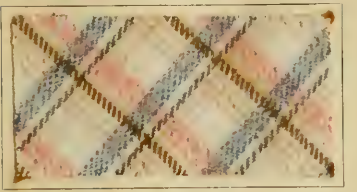

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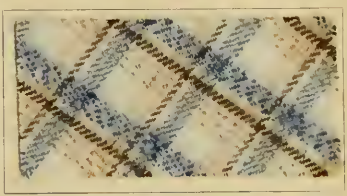

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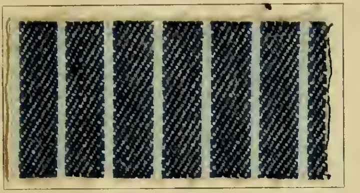

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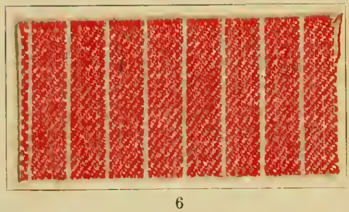

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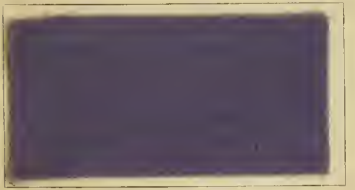

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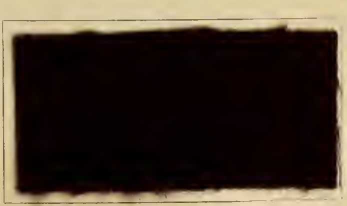


10

Recipes for page 51.

1.

Violet: 0,5 % Thiogene Violet B
0,5 % Thiogene Rubine O.
Black: 5 % Thiogene Diamond Black V
7 % Thiogene Diamond Black B.

2.

4 % Thiogene Rubine O,
aftertreated with copper.

3.

3,4 % Thiogene Yellow GG
1,6 % Thiogene Green BL extra.

4.

Blue: 2,5 % Thiogene Cyanine G.
Black: 12 % Thiogene Black M liquid
(old bath).

5.

Grey: 0,3 % Thiogene Black B 2 R conc.
Violet: 15 % Thiogene Rubine O,
aftertreated with copper.

6.

Lightbrown: 0,7 % Thiogene Brown G 2 R.
Darkbrown: 10 % Thiogene Brown G 2 R.

7.

2 % Thiogene Cyanine O.

8.

Blue: Indigo MLB paste 20 %
Zinc-Lime vat.
Drab: 0,5 % Thiogene Brown R
0,1 % Thiogene Orange R
0,1 % Thiogene Golden Yellow AO.

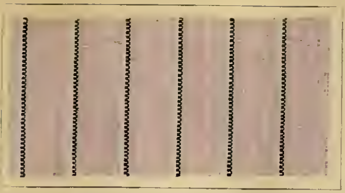
9.

0,75 % Thiogene Green 2 G
0,75 % Thiogene Green BL extra
0,2 % Thiogene Golden Yellow AO.

10.

Pale Green: as pattern 9.
Darkgreen: 7,5 % Thiogene Green GL extra
7,5 % Thiogene Green BL extra.

SHIRTINGS.



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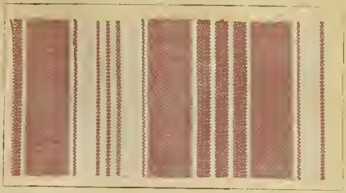

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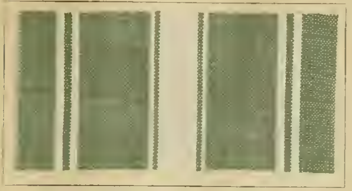

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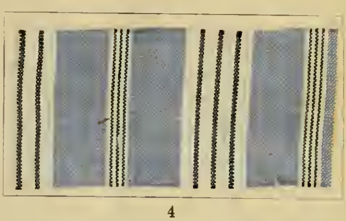

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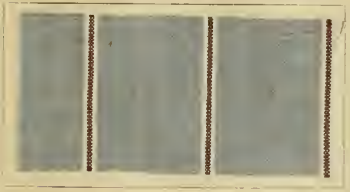

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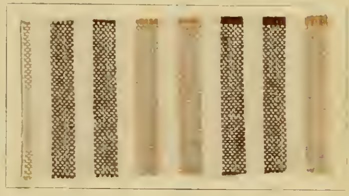

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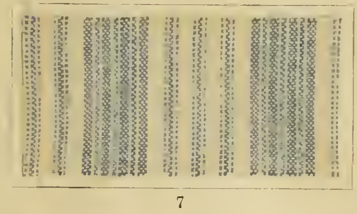

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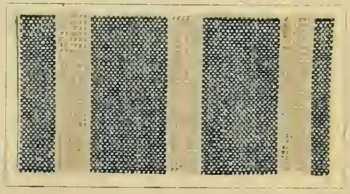

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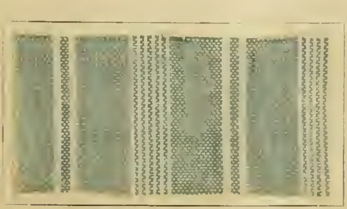

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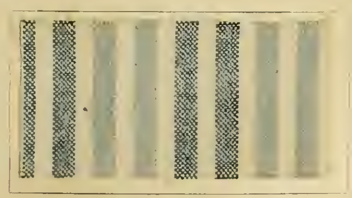


10

Recipes for page 53.

1.

0,045 % Thiogene Brown GR
0,045 % Thiogene Diamond Black V.

2.

0,1 % Dianil Blue G
0,01 % Dianil Yellow 3 G.

3.

0,2 % Thiogene Diamond Black V.

4.

0,2 % Dianil Pink BD
0.01 % Dianil Pure Yellow HS.

5.

Pink: 0,3 % Dianil Pink BD.
Cream: 0,035 % Dianil Fast Brown B
0,035 % Oxydianil Yellow G.

6.

1,5 % Patent Dianil Black FF conc.
1,5 % Dianil Black ES.

7.

Blue: 0,15 % Dianil Blue H 6 G.
Drab: 0,035 % Dianil Fast Brown B
0.035 % Oxydianil Yellow G.

8.

0,15 % Methylene Heliotrope O
0,01 % Methylene Blue 3 R
3 % acetic acid
(on tannin-Tartar emetic).

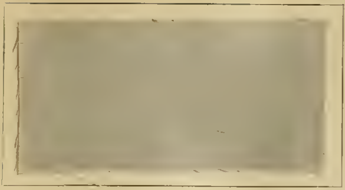
9.

0,035 % Methylene Heliotrope O
3 % acetic acid
(on tannin-Tartar emetic).

10.

Warp: 18 % Thiogene Black 2 B liquid
(old bath).
Weft: 1,25 % Thiogene Black BRR conc.

CORSET MATERIALS.



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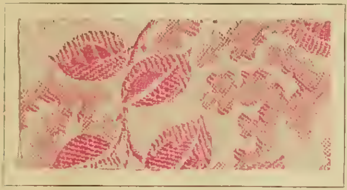

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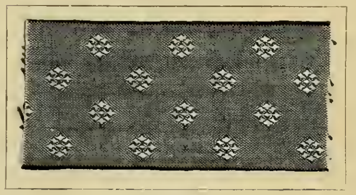

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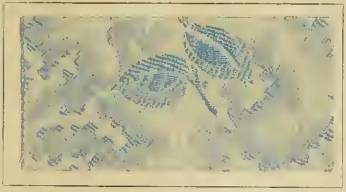

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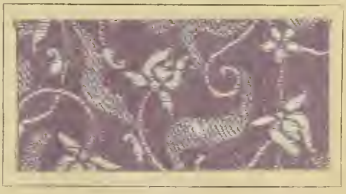

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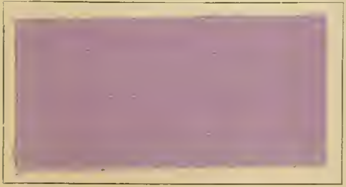

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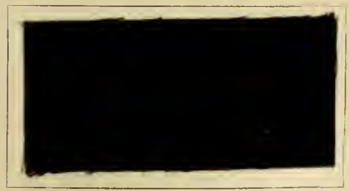

10

Recipes for page 55.

(Compare page 15.)

1.

Dyed as roving.
8 % Thiogene Black M conc.

2.

6 % Melanogene Blue BG
(old bath).
After-fixed with
4 % fixing salt
0.1 % Methylene Blue BB conc.
0.04 % Methyl Violet 8B superior
2 % acetic acid.

3.

Dyed as roving.
8 % Thiogene Darkblue BTL.

4.

Indigo MLB.

5.

Indigo MLB.

6.

Blue: 10 % Thiogene Cyanine G
(initial bath).
Black: 20 % Thiogene Black M. liquid.

7.

12 % Thiogene Blue B
(initial bath).
Aftertreated with
2 % bichrome
2 % copper vitriol
2 % acetic acid.

8.

Pale Blue: 8 % Thiogene Cyanine O.
Darkblue: 8 % Thiogene Darkblue BTL
aftertreated with
2 % bichrome
2 % copper vitriol
2 % acetic acid.
Yellow: 0,03 % Oxydianil Yellow O.

9.

Indigo MLB.

10.

Indigo MLB.

JACKET- AND APRON MATERIALS.

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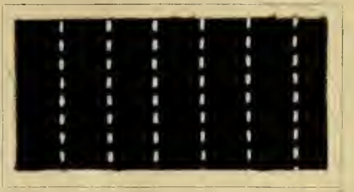

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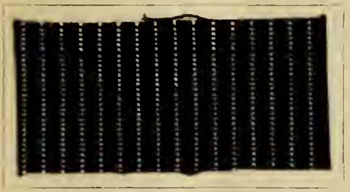

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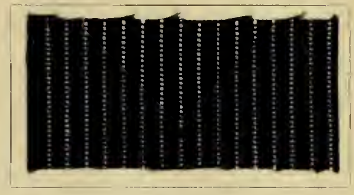

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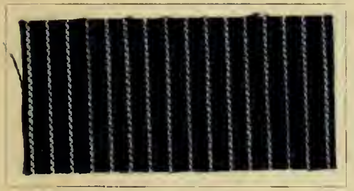

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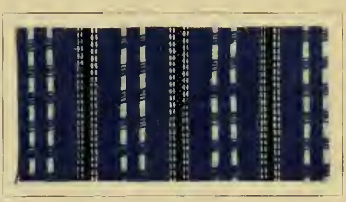

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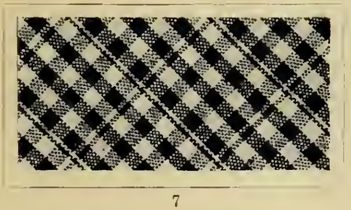

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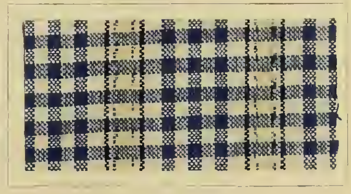

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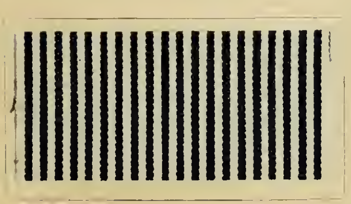

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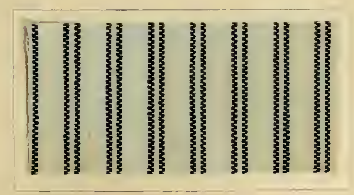

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Ad page 57.

For multi-coloured staple goods Indigo still plays as important a part as in the past.

Indigo Blue is generally dyed upon yarns in the hank, either on the iron-vitriol vat, the zinc dust vats, and latterly on the hydrosulfite vat. With the latter are used bent flat iron rods which, when taken out of the vat, can pass through the squeezing apparatus.

The dye vats for cotton yarns are usually 5′7″ deep, 2′8″ long and 2′2″ broad, and for greater convenience are placed in such a manner that their top is 2′8″ from the floor. Over each vat, at a height of about 2′8″ there is a wringing pole which can be placed above the centre of the vat by sliding onto a beam.

The yarn is boiled before dyeing, according to quality, for $1^1/_2$ to 3 hours without any admixtures, then wound off, beaten out, and hung on sticks in 2 lbs divisions.

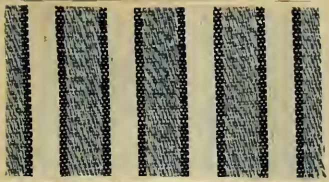
It is generally worked in lots of 50 lbs which two workmen for each draft can pass through in 35 to 40 minutes. After passing through, the vat is stirred, and can be used again after 3 to 4 hours. On the hydrosulphite vat working can proceed without interruption.

The vats can usually be employed for 3 to 5 sticks at a time. The dyeing operation is begun by first entering one stick, passing it through twice, then adding the second stick and passing the first stick once more. Continuing in the same manner until the fifth stick has been brought into the vat, the first stick is taken out, wound off over the vat and replaced by another stick. In the same way the whole lot is worked. On being wound off over the vat, the yarn is at once wound off twice again on a wringing pole, equalized and taken off. In the next draft the yarn taken first out of the vat is worked over in the first place, and so forth.

The dyeing operation is begun on vats with weak solutions, then gradually carried on in vats of greater strength, until the desired shade is approximately reached. In order to test the shade, only one stick is passed through the vat until it is hit. The testing must be done with wet material against a wet specimen.

It is advisable to allow the yarns to lie some time after dyeing, if necessary over night, then to remove the acid and to rinse. The quantities of acid must be kept as small as possible, so that they are sufficient merely for neutralizing the lime, and the smallest amount of rinsing becomes necessary.

INDIGO STAPLE GOODS



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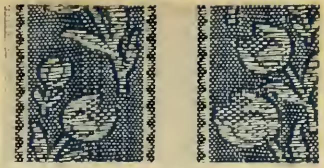

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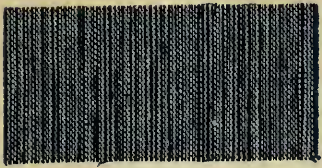

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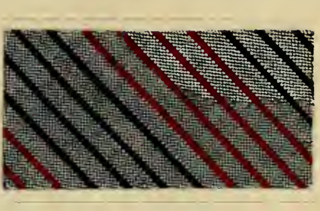

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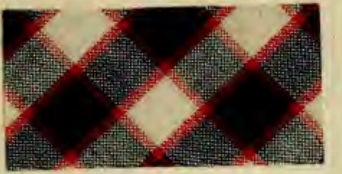

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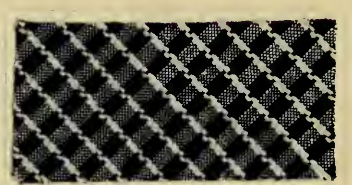

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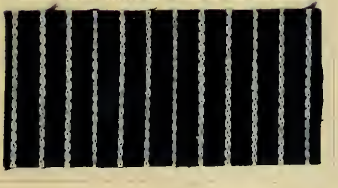

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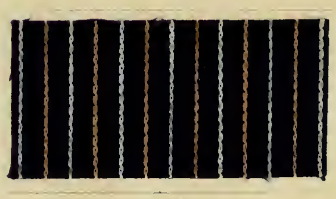

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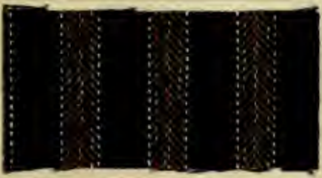

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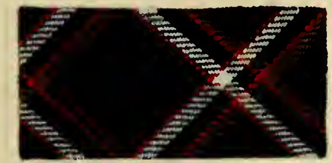


10

Recipes for page 59.

1.

Bleached Cotton warp dyed with
0.25 % Methylene Heliotrope O,
(on tannin tartar emetic).

2.

2 % Thiogene Cyanine G

3.

Bleached Cotton warp dyed with
0,9 % Thiogene Brown GC
0,1 % Thiogene Black NA.

4.

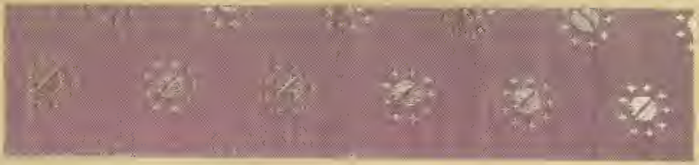
Violet: 5 % Thiogene Heliotrope O
(initial bath).
Brown: 4 % Thiogene Brown GR
(initial bath).
Green: 5 % Thiogene Green GL extra,
4 % Thiogene Yellow GG.

5.

2 % Thiogene Brown GR.

MATERIALS FOR BLOUSES.

Silk Battiste.



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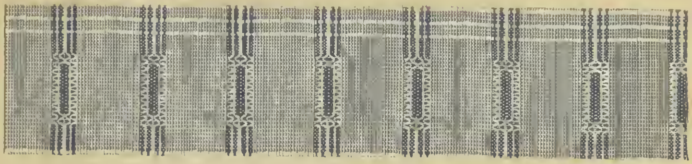

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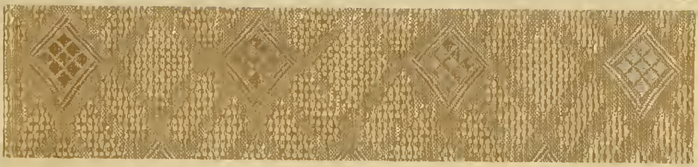

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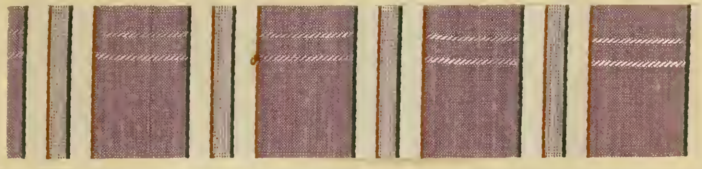

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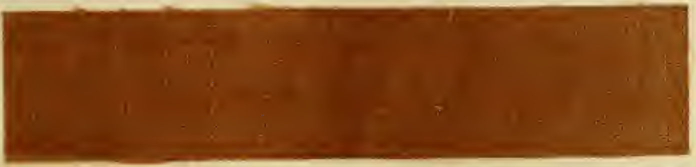


5

Recipes for page 61.

1.

Violet: 8 % Thiogene Heliotrope O.
Black: 6 % Thiogene Black M conc.
(old bath).

2.

Drab: 1,7 % Thiogene Khaki O.
Black: 6 % Thiogene Black MM conc.
(old bath).

3.

Pale Blue: 3 % Thiogene Cyanine G.
Dark Blue: 10 % Thiogene Cyanine O.

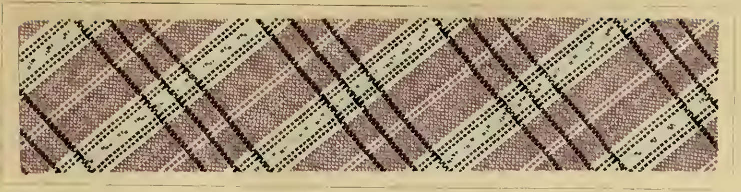
4.

Red: 2,22 % Thiogene Rubine O.
Black: 6 % Thiogene Black MM conc.
(old bath).

5.

Black: 6 % Thiogene Black BRR conc.
(old bath).
Grey: 1 % Thiogene Black BRR conc.
Red: 9 % Alizarine Red No. 1 paste 20 %
(New Red).

BLOUSE- AND DRESS MATERIALS.



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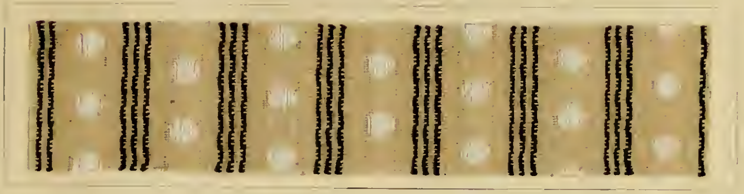

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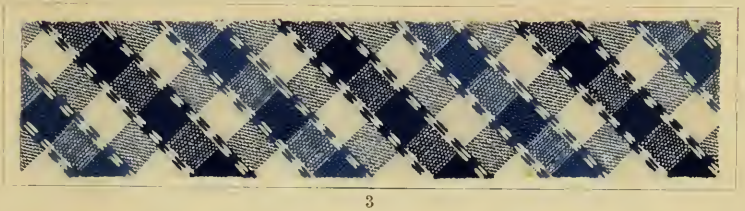

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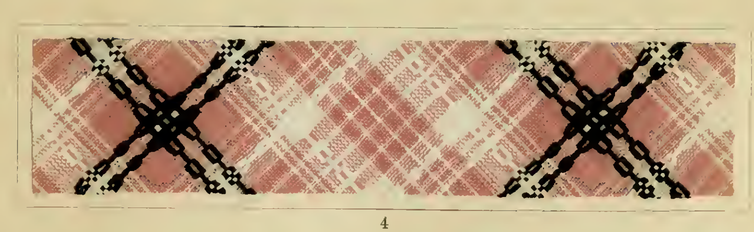

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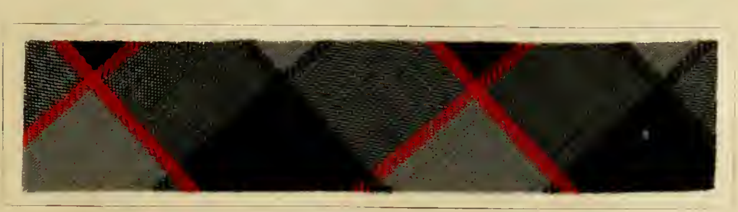

5

Recipes for page 63.

1.

Green: 3 % Brilliant Green cryst. extra,
5 % acetic acid
(on sumach tartar emetic).
Black: Diphenyl Black Base I.
Red: Paranitraniline Red.

2.

Green: 1 % Methylene Green GG
0,2 % Methylene Yellow H.
Red: 8 % Alizarine Red No. 1 paste 20 %.
Claret: 7 % Alizarine Claret R paste
4 % Alizarine Red No. 1 paste 20 %.
Black: 10 % Thiogene Black BRR conc.
(initial bath).

3.

Violet: 1 % Methylene Heliotrope O
0,5 % Methylene Blue BB conc.
3 % acetic acid
(on tannin tartar emetic).
Green: 0,75 % Methylene Green GG
0,15 % Methylene Yellow H
3 % acetic acid
(on tannin tartar emetic).
Black: 10 % Thiogene Black BRR conc.
(initial bath).

4.

Blue: 0,75 % Methylene Blue R conc.
5 % acetic acid.
(on tannin tartar emetic).
Black: 10 % Thiogene Black MM conc.

5.

Red: Paranitraniline Red.
Black: 22 % Thiogene Black BRR liquid
(initial bath).
Darkgrey: 3 % Thiogene Black BRR liquid
Lightgrey: 0,5 % Thiogene Black BRR liquid

6.

Claret: α-Naphthylamine Claret.
Black Print: Diphenyl Black Base I.
Black: 12 % Thiogene Black BRR conc.
(initial bath).

7.

12 % Melanogene Blue B.

8.

5 % Thiogene Diamond Black V
7 % Thiogene Diamond Black B
(initial bath).

9.

Red: Azophor Red.
Black: 4 % Dianil Black CR
(aftertreated with Azophor).
Green: 1,2 % Methylene Green GG
Yellow: 0,3 % Auramine conc.

10.

Dark Heliotrope: 0,3 % Methylene Heliotrope O
0,05 % Methylene Blue R conc.
5 % acetic acid
(on tannin tartar emetic).
Heliotrope: 0,15 % Methylene Heliotrope O
0,025 % Methylene Blue R conc.
5 % acetic acid
(on tannin tartar emetic).
Red Violet: 0,1 % Methylene Heliotrope O
0,1 % Methylene Violet 3RA extra
5 % acetic acid.
Black: 22 % Thiogene Black M liquid
(initial bath).

BLOUSE- AND DRESS MATERIALS.

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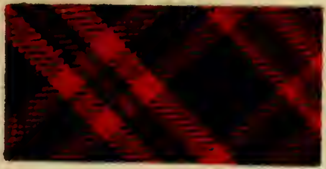

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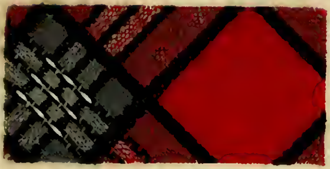

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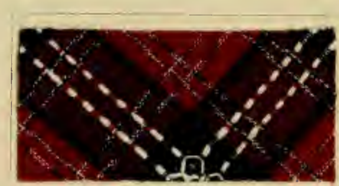

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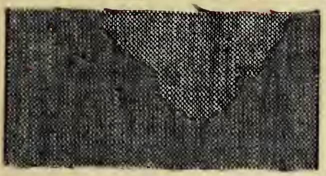

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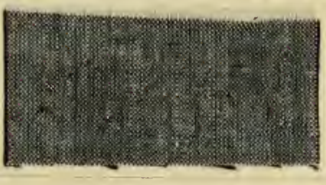

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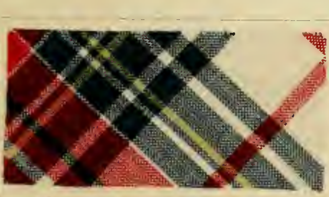

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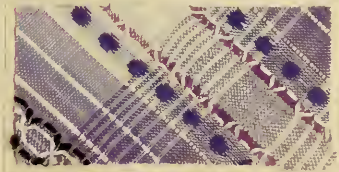


10

Recipes for page 65.

1.

1,7 % Thiogene Khaki O.

2.

10 % Thiogene Black MM conc.
(initial bath).

3.

Drab: 0,12 % Dianil Fast Brown B
0,1 % Oxydianil Yellow O
0,04 % Dianil Black CR
aftertreated with
0,5 % copper vitriol
0,5 % chrome potash
1 % acetic acid.
Blue: 0,15 % Dianil Blue H6G
0,02 % Oxydianil Yellow O.

4.

0,1 % Dianil Blue H6G.

5.

Grey: 0,08 % Dianil Black CR
0,06 % Dianil Fast Brown B
aftertreated with
0,5 % copper vitriol
0,5 % chrome potash
1 % acetic acid.
Pink: 0,15 % Dianil Fast Scarlet 8BS
0,02 % Toluylene Orange R.

6.

Red: 2,2 % Thiogene Rubine O.
Black: 6 % Thiogene Black MM conc.
(old bath).

7.

Blue: 0,2 % Thionine Blue GO
5 % acetic acid
2 % tannin
1 % Tartar emetic.
After the one bath method (compare vol. I, page 131).
Black: 22 % Thiogene Black M liquid
(initial bath).

8.

Green: 1 % Thiogene Green GL extra
1 % Thiogene Green BL extra.
Black: 22 % Thiogene Black BRR liquid
(initial bath).

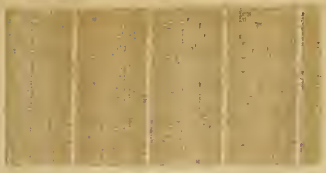
9.

Black (Warp): 6 % Thiogene Black B2R liquid
6 % Thiogene Black M liquid
(old bath).
Blue: 0,1 % Thionine Blue GO
(on tannin tartar emetic).
Black (Weft): Wool.

10.

Blue: 10 % Thiogene Blue B.
Green: Wool.

BLOUSE- AND DRESS MATERIALS.



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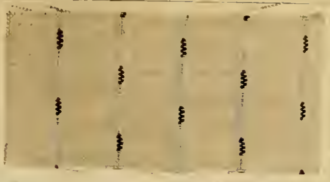

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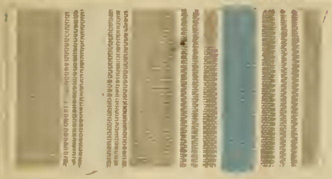

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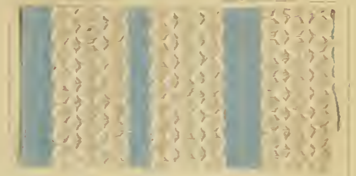

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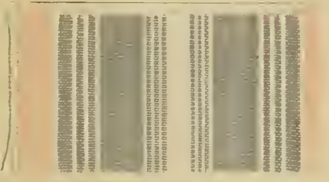

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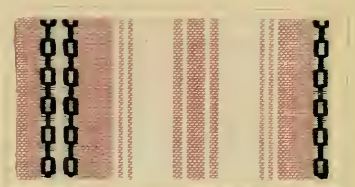

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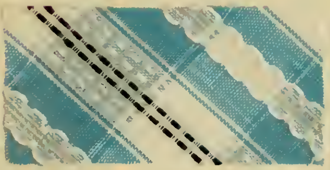

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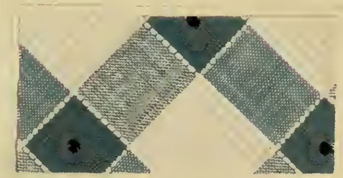

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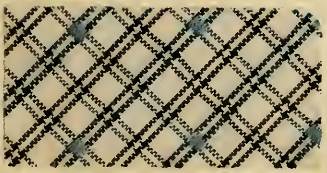

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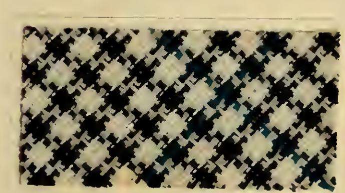


10

Recipes for page 67.

1.

Khaki.

Jigger dyeing.

3,5 % Thiogene Khaki O
aftertreated with
0,5 % copper vitriol
0,5 % chrome potash
1 % acetic acid 8° Bé (12° Tw).

2.

Fieldgrey.

Jigger dyeing.

0,7 % Thiogene Brown GC
0,4 % Thiogene Black M conc.
aftertreated with
0,5 % copper vitriol
0,5 % chrome potash
1 % acetic acid 8° Bé (12° Tw).

3.

Jigger dyeing.

2,5 % Thiogene Orange RR
1,5 % Thiogene Catechu R.

4.

Jigger dyeing.

4 % Thiogene Catechu R
3 % Thiogene Brown GRR.

5.

Green: 6 % Thiogene Green GL extra
Brown: 3 % Thiogene Brown GRR
1 % Thiogene Rubine O.

6.

Green: 0,5 % Flavophosphine G conc. new
0,23 % Methylene Blue BB conc.
3 % acetic acid 8° Bé (12° Tw).
(on tannin tartar emetic).
Brown: 8 % Thiogene Brown GR
0,5 % Thiogene Black MM conc.

7.

Blue: 4 % Dianil Blue R
topped with
0,2 % Methylene Blue R
Orange (Warp): 2 % Aurophenine O
0,5 % Toluylene Orange R
Orange (Weft): 3 % Dianil Orange G
0,1 % δ-Purpurine 5B.

8.

Green: 3 % Malachite Green cryst. extra
(on tannin tartar emetic).
Red: 4 % Dianil Red 10B.
Black: 5 % Patent Dianil Black FFT conc.

9.

Yarn dyed.

Paranitraniline Red.

10.

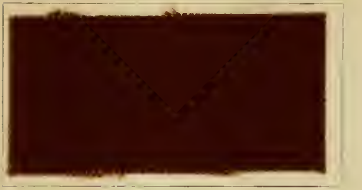
Yarn dyed.

14 % Thiogene Black BRR liquid
(old bath).

KHAKI TWILL, BAGGING, SHOE CANVAS.

1

2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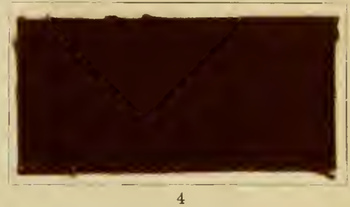
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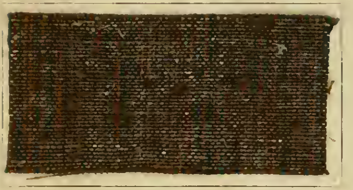
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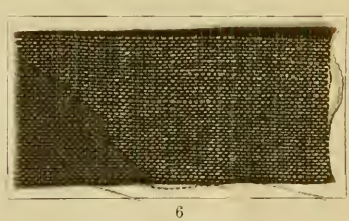
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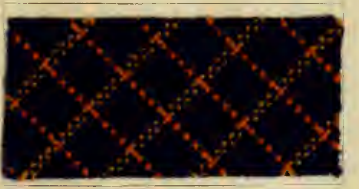
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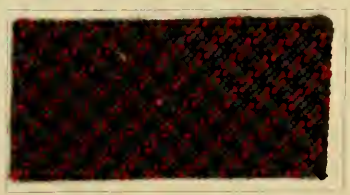
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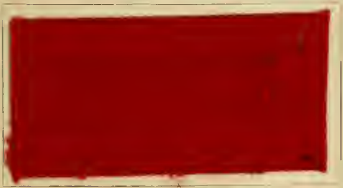
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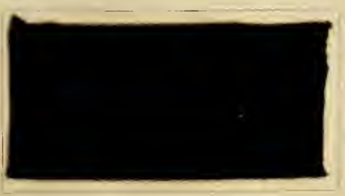

10

Recipes for page 69.

1.

Yarn dyed.

2 % Thiogene Dark Red R
1,5 % Thiogene Orange R
aftertreated with
2 % copper vitriol
2 % chrome potash
3 % acetic acid 8° Bé (12° Tw).

2.

Yarn dyed.

2 % Thiogene Yellow G
2 % Thiogene Brown R
aftertreated with
2 % copper vitriol
2 % acetic acid 8° Bé (12° Tw).

3.

Yarn dyed.

4,5 % Thiogene Khaki O
aftertreated with
1 % copper vitriol
1 % chrome potash
2 % acetic acid 8° Bé (12° Tw).

4.

Yarn dyed.

3 % Thiogene Brown GR
3 % Thiogene Orange RR
aftertreated with
1,5 % copper vitriol
1,5 % chrome potash
3 % acetic acid 8° Bé (12° Tw).

5.

Jigger dyeing.

(Combination of Catechu and Dianil Colours).

2 % Catechu Red, solution
0,5 % Dianil Brown MH
0,25 % Dianil Brown 3GO
0,12 % δ-Purpurine 5B
aftertreated with
0,25 % copper vitriol
0,25 % chrome potash.

6.

Jigger dyeing.

0,4 % Thiogene Blue RR
0,16 % Thiogene Black MM conc.
aftertreated with
2 % copper vitriol
2 % acetic acid 8° Bé (12° Tw).

7.

Jigger dyeing.

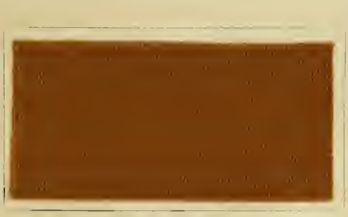
1,35 % Thiogene Green GL extra
0,23 % Thiogene Black MM conc.
aftertreated with
2 % copper vitriol
2 % acetic acid 8° Bé (12° Tw).

SAIL CLOTH, TENT CANVAS etc.

1

2

3



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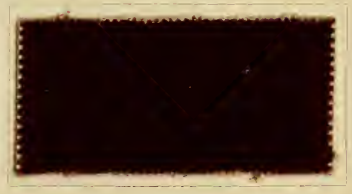

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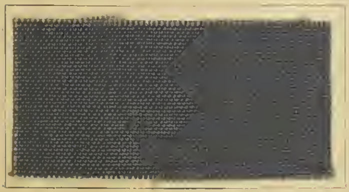

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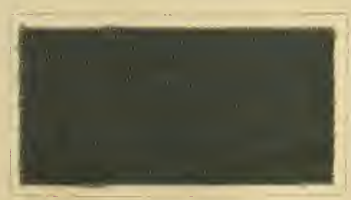


7

Recipes for page 71.

1.

8 % Thiogene Black M conc.

2.

Brown: 5 % Thiogene Dark Red R
5 % Thiogene Brown S.
Drab: 0,2 % Thiogene Brown GR
0,2 % Thiogene Brown R
aftertreated with
1 % copper vitriol
2 % acetic acid 8° (12° Tw).
Red: 8 Alizarine Red No. 1 paste 20 %.

3.

4 % Thiogene Blue B
1,5 % Thiogene Dark Blue BL
(old bath).

4.

5 % Primuline O
aftertreated with chloride of lime.

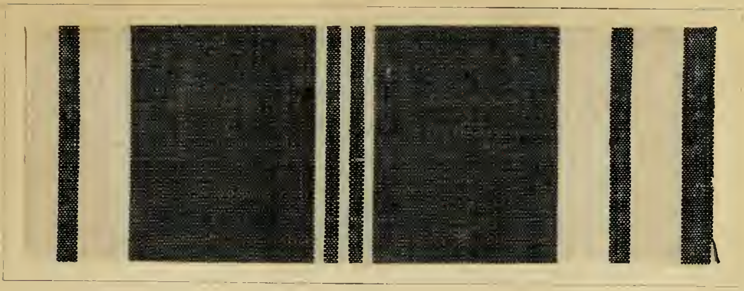
5.

Yellow: 0,4 % Oxydianil Yellow O.
Red: 8 % Alizarine Red No. 1 paste 20 %.

6.

3 % Thiogene Brown GR.

MATERIALS FOR BLINDS AND MARQUEES.



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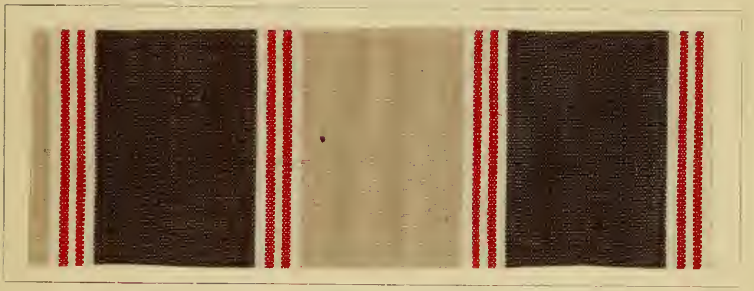

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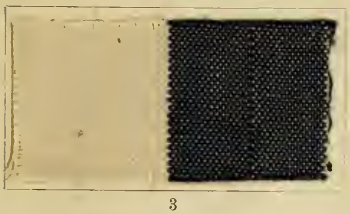

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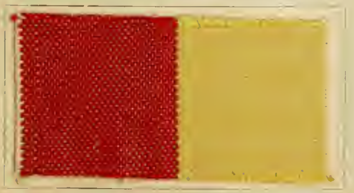

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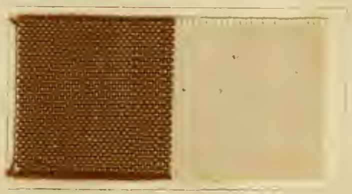


6

Recipes for page 73.

1.

Red:	8 %	Alizarine Red No. 1 paste 20 %
Claret:	3,5 %	Dianil Crimson G
	0,75 %	Dianil Fast Red PH aftertreated with
	3 %	copper vitriol
	2 %	acetic acid 8° Bé (12° Tw).
Blue:	2,5 %	Dianil Azurine G aftertreated with
	3 %	copper vitriol
	2 %	acetic acid 8° Bé (12° Tw).
Yellow:	0,75 %	Oxydianil Yellow O.

2.

Green:	5 %	Thiogene Green GG
	5 %	Thiogene Yellow GG.
Violet:	10 %	Thiogene Rubine O aftertreated with
	3 %	copper vitriol
	2 %	acetic acid (8° Bé) 12° Tw.
Drab:	6 %	Thiogene Golden Yellow AO aftertreated with
	1 %	chrome potash
	0,5 %	copper vitriol
	2 %	acetic acid.

3.

Jigger dyeing.

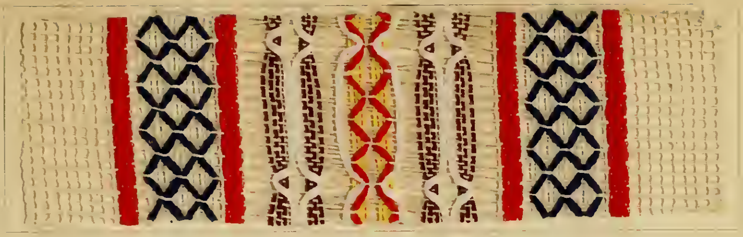
0,01 % Aurophenine O.

4.

Jigger dyeing.

0,5 % Aurophenine O.

CURTAIN MATERIALS.



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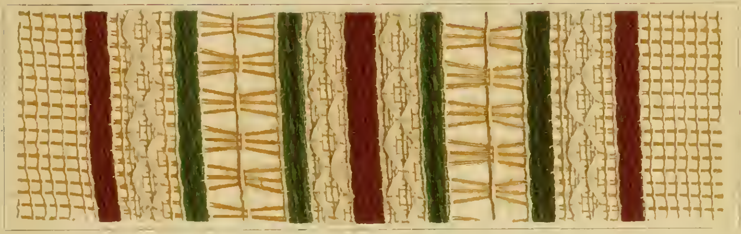


2

3

4

Recipes for page 75.

1.

0,24 % Thiogene Black M conc.
0,48 % Thiogene Brown S
0,12 % Thiogene Yellow GG.

2.

Pink (Linen): 0,3 % Dianil Fast Scarlet 8BS
0,02 % Oxydianil Yellow G
Red: 8 % Alizarine Red No. 1 paste 20%.

3.

4,5 % Thiogene Yellow GG
1,7 % Thiogene Green B
1,5 % Thiogene Orange RG.

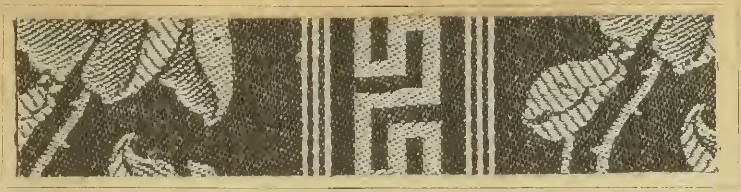
4.

Yellow (Linen): 0,3 % Oxydianil Yellow O.
Red: 8 % Alizarine Red No. 1 paste 20%.

5.

Brown: 4 % Thiogene Brown GC
0,8 % Thiogene Brown RR
0,4 % Thiogene Orange R.
Green: 7 % Thiogene Green GG
4,4 % Thiogene Orange R.

DAMASKS.



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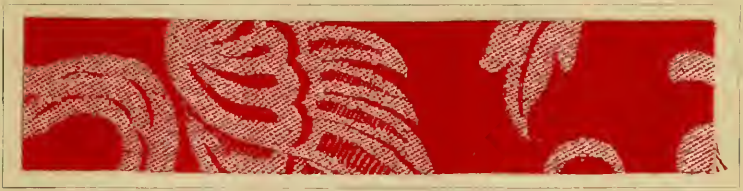

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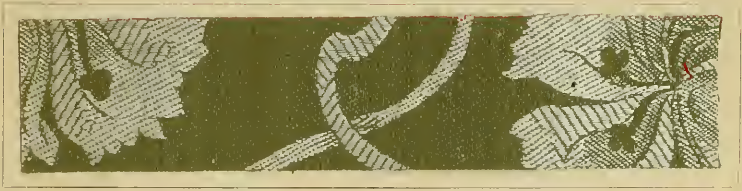

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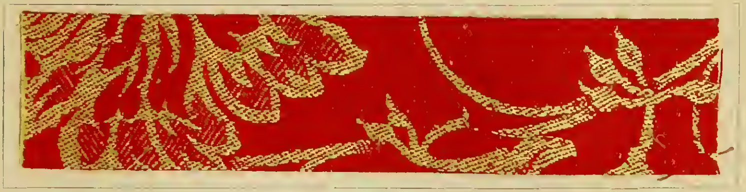


4

5

Recipes for page 77.

1.

Blue 1: 0.2 % Methylene Blue BB conc.
Blue 2: 0,3 % Methylene Blue BB conc.
Blue 3: 0,75 % Methylene Blue BB conc.
Blue 4: 2 % Methylene Blue BB conc.
Blue 5: 6 % Melanogene Blue B
3 % fixing salt
0,1 % Methylene Blue BB conc.
Blue 6: 10 % Melanogene Blue B
5 % fixing salt.

Colours 1—4 produced in acetic acid bath on tannin tartar emetic mordant.

Brown 1: 0,5 % Thiogene Brown GG.
Brown 2: 0,9 % Thiogene Brown GG.
Brown 3: 2,25 % Thiogene Brown GG.
Brown 4: 2,25 % Thiogene Brown GR.
Brown 5: 2,25 % Thiogene Brown GR.
0,35 % Thiogene Brown S.
Brown 6: 2,25 % Thiogene Brown GR
1 % Thiogene Brown S.

2.

Blue 1: 0,03 % Methylene Blue R
0,02 % Methylene Blue RR.
Blue 2: 0,05 % Methylene Blue R
0,06 % Methylene Blue RR.
Blue 3: 0,12 % Methylene Blue R.
0,15 % Methylene Blue RR.
Blue 4: 0,25 % Methylene Blue R
0,4 % Methylene Blue RR.
Blue 5: 0,6 % Methylene Blue R
0,9 % Methylene Blue RR.
Blue 6: 2 % Methylene Blue RR
0,5 % Methylene Blue R.

Colours produced in acetic acid bath on tannin tartar emetic mordant.

Brown 1: 0,07 % Aurophenine O
0,015 % Dianil Brown 3GO.
Brown 2: 0,12 % Aurophenine O
0,04 % Dianil Brown 3GO.
Brown 3: 0,2 % Aurophenine O
0,12 % Dianil Brown 3GO
0,03 % Dianil Brown M.
Brown 4: 0,45 % Dianil Brown 3GO
0,07 % Dianil Brown M
0,02 % Patent Dianil Black FF conc.
Brown 5: 0,7 % Dianil Brown 3GO
0,15 % Dianil Brown M
0,04 % Patent Dianil Black FF conc.
Brown 6: 1 % Dianil Brown 3GO
0,7 % Dianil Brown M
0,07 % Patent Dianil Black FF conc.

3.

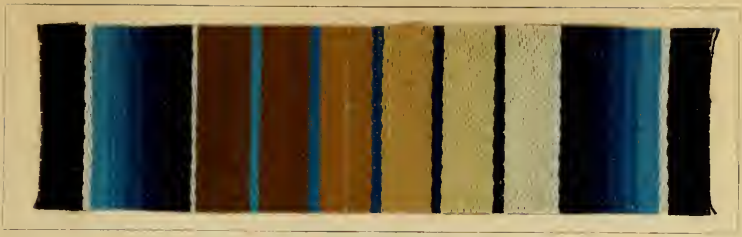
Red (Warp): 9 % Alizarine Red No. 1 paste 20 %.
Pink (Warp): 1 % Alizarine Red 1 B paste 20 %.
Red (Weft): Azophor Red.

4.

Warp: 0,55 % Methylene Blue R conc.
0,05 % Vesuvine 4 BG conc.
5 % acetic acid 8° Bé (12° Tw).
Weft: 0,9 % Methylene Blue R conc.
0,1 % Vesuvine 4 BG conc.
5 % acetic acid 8° Bé (12° Tw).

Produced on tannin tartar emetic mordant.

MATTRESS CLOTHS.



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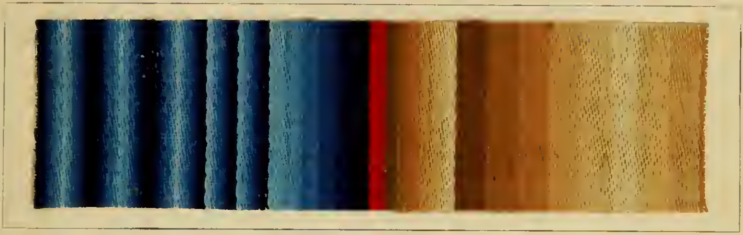

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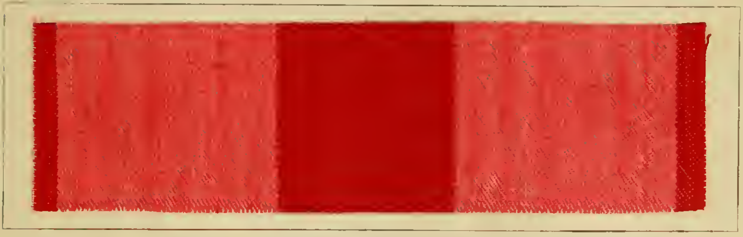

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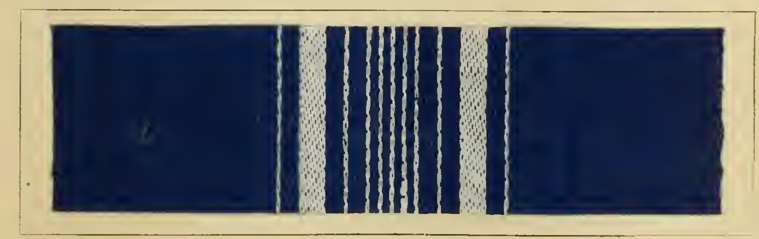


4

Recipes for page 79.

1.

10 % Melanogene Blue B,
aftertreated with
5 % fixing salt,
3 % acetic acid 8° Bé (12° Tw.)

2.

Blue: Indigo MLB paste 20 %.
Light Pink: 0,35 % Alizarine Red 1 B paste 20 %.
Pink: 1,5 % Alizarine Red No. 1 paste 20 %.
Red: 6 % Alizarine Red No. 1 paste 20 %.
1 % Alizarine Red 5 F paste 20 %.

3.

Blue: Indigo MLB paste 20 %.
Red: 7 % Alizarine Red No. 1 paste 20 %.
Pink: 0,5 % Alizarine Red 1 B paste 20 %.
Pink Print: Alizarine Red No. 1 paste 20 %.
Cream: 0,02 % Oxydianil Yellow O.

4.

Red: Azophor Red.
Blue: 0,75 % Ethyl Blue BF,
(on tannin tartar emetic).
Blue Print: Ethyl Blue BF.

5,

Red: 8 % Alizarine Red 2 A paste 20 %.
Red Print: Alizarine Red No. 1 paste 20 %.

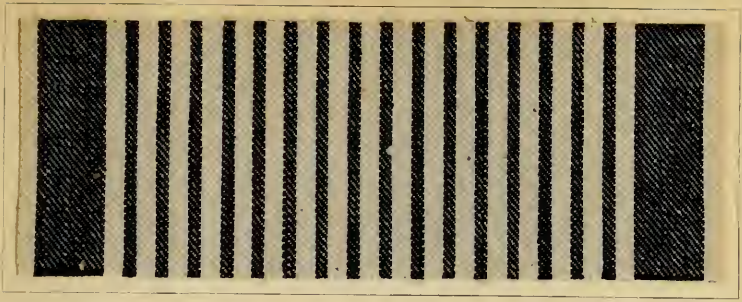
6.

Blue (Warp): 1,5 % Victoria Blue R,
5 % acetic acid.
(on tannin tartar emetic).
Blue (Weft): 1 % Methylene Blue BB conc.
5 % acetic acid
(on tannin tartar emetic).

7.

8 % Alizarine Red No. 1 paste 20 %.

BEDDING.



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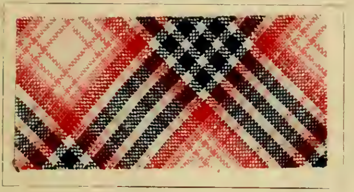

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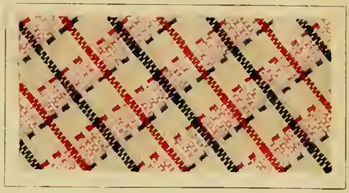

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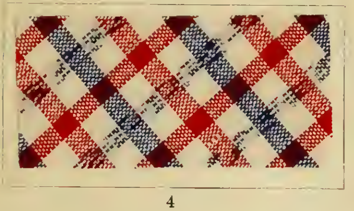

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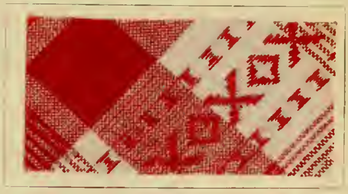

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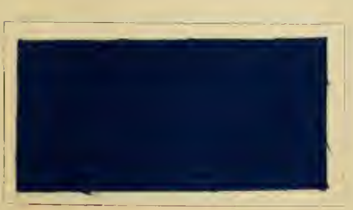

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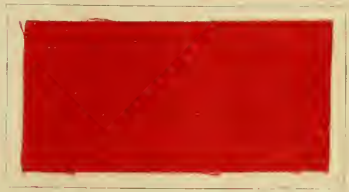


7

Recipes for page 81.

1.

Blue: Indigo paste 20 %.
Brown: 3,5 % Thiogene Brown GR.
2 % Thiogene Brown GC.
1,5 % Thiogene Orange R.
Red: 7 % Alizarine Red No. 1 paste 20 %.
2 % Alizarine Red 5 F paste 20 %.

2.

2 % Dianil Direct Yellow S.

3.

0,75 % Flavophosphine 4 G conc. new.
0,55 % Flavophosphine G conc new.
0,16 % Methylene Blue BB conc.
2 % acetic acid 8° Bé (12° Tw)
(on tannin tartar emetic).

4.

Red: 7,5 % Alizarine Red 1 B paste 20 %.
Blue: Indigo MLB paste 20 %.

5.

7,5 % Alizarine Red No. 1 paste 20 %.

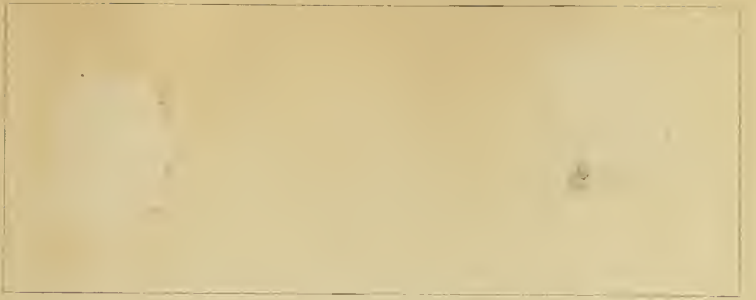
6.

8 % Thiogene Blue RR.

7.

Red: 6 % Alizarine Red No. 1 paste 20 %.
1 % Alizarine Red 5F paste 20 %.
Blue: Indigo MLB paste 20 %.

TABLE- AND HOUSEHOLD CLOTHS.



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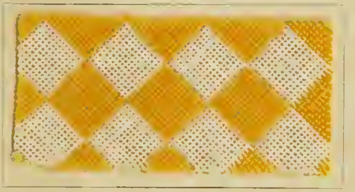

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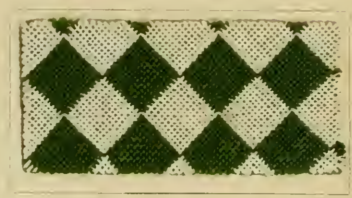

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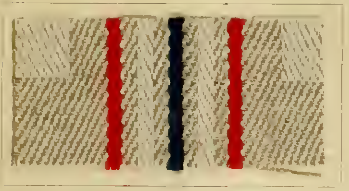

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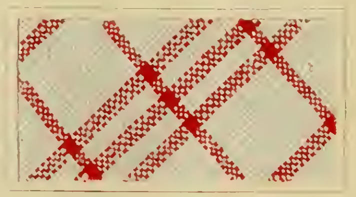

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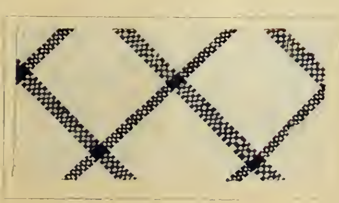

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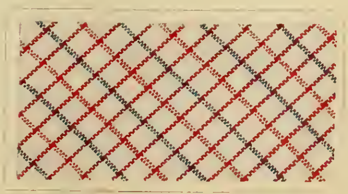


7

Recipes for page 83.

1\.

9 % Alizarine Red 2A blueish paste 20 %.

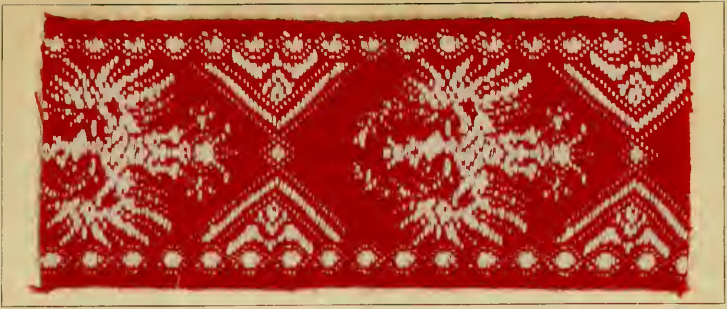
2\.

Indigo MLB/T paste 20 %.
Dyed on the hydrosulphite vat in 3 drafts.

3\.

Indigo MLB paste 20 %.
Dyed on the zinc-lime vat in 3 drafts.

TABLE CLOTH BORDERS.



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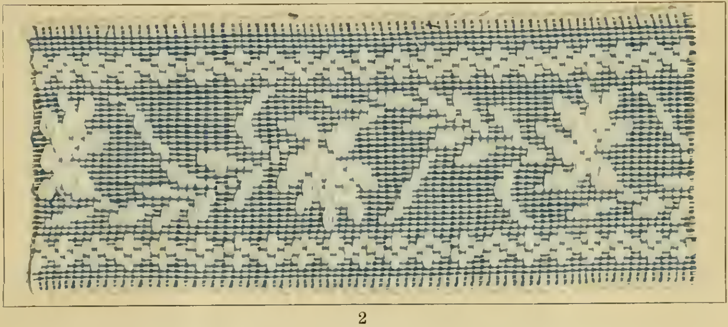

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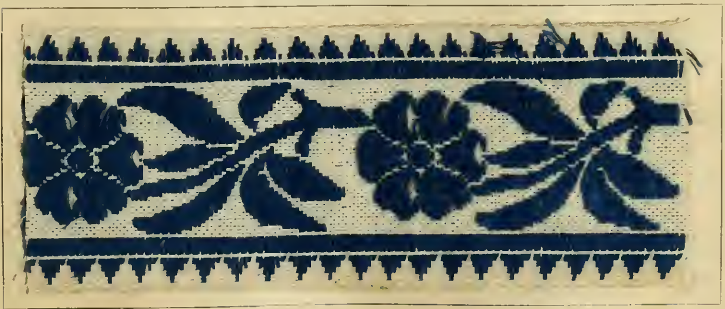


3

Recipes for page 85.

Black: 22 % Thiogene Black BRR liquid
(initial bath).
Red: 3,5 % Dianil Fast Scarlet 8BS.

2.

Black: same as for No. 1.
Violet: 4 % Thiogene Rubine O
aftertreated with
1 % copper vitriol
2 % acetic acid 8° Bé (12° Tw).

3.

12 % Thiogene Blue B
(initial bath).

4.

9 % Alizarine Red No. 1 paste 20 %.

5.

12,5 % Thiogene Black BB conc.

6.

0,5 % Rosazeine 4G
0,1 % Rosazeine Scarlet G extra
5 % acetic acid 8° Bé (12° Tw).

7.

1,5 % Safranine 104
0,1 % Vesuvine O
5 % acetic acid 8° Bé (12° Tw).

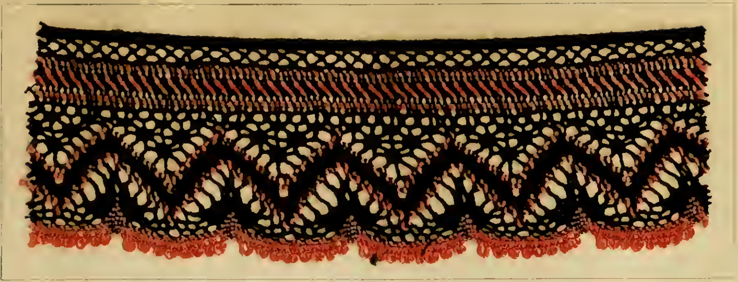
8.

0,4 % Victoria Blue B
2 % acetic acid 8° Bé (12° Tw).

9.

0,4 % Brilliant Green cryst. extra
0,4 % Auramine O
2 % acetic acid 8° Bé (12° Tw).

LACE, RIBBONS, TWINE.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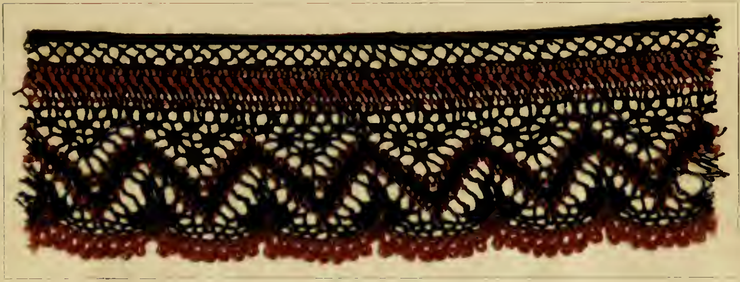
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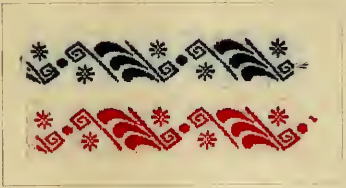
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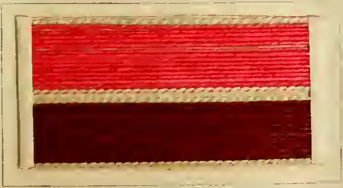
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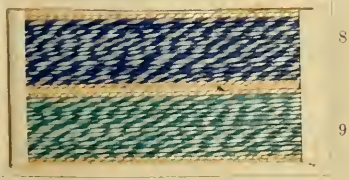
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9

THE DYEING OF OTHER VEGETABLE FIBRES.

Besides cotton (which, of all vegetable fibres, has the largest consumption), a number of others are employed for industrial purposes. They have been divided by F. von Hönel into the following seven groups:

a) Textile fibres.

Flax
Hemp
Jute
Vegetable Silk
Chinagrass
Nettle Fibre
Aloe Fibre
Sanseverina Fibre
New Zealand Flax.

b) Paper Fibres.

Flax
Cotton
Hemp
Straw Fibre
Esparto
Wood Fibre
Wood Cellulose
Bamboo Fibre
Mulberry Tree Bast
Hop Fibre.

c) Upholstery Materials.

Vegetable Horsehair
Fibre
Crin d'Afrique
Sisal
Seaweed
Wood Wool
Poplar Wool.

d) Brush Materials.

Coir Fibre
Pita Fibre
Kitool or Släm
Piassava
Ricetree Root
Esparto.

e) Rope and Twine Materials.

Hemp
New Zealand Flax
Jute
Flax
Piassava
Coir Fibre
Manilla Hemp
Pita Hemp.

f) Basts.

Elmtree-, Limetree-, Cuba-Bast.

g) Plaiting Materials.

Spanish Cane
Straw
Pia Fibre
Various Barks
Bamboo
Esparto
Many Soft Woods.

Specimens of a number of those fibres in the raw state are given on pages 89 and 90. They consist mostly of long stapled tubular cells, pre-eminently of cellulose, but they are often partly lignified and interspersed with dyestuffs, resinous, waxy and fatty substances.

These keton-like by-products showing a slight acid reaction (which cannot be wholly removed even by bleaching) enable a number of those fibres, contrary to cotton, to take up basic colours direct without previous mordanting.

In many cases animal and vegetable fibres, or also various kinds of vegetable textile fibres are manufactured conjointly. The following table, compiled by R. Gnehm, serves for testing such mixture of fibres:

<table>
<tr><td colspan="10">Caustic potash or soda of 10 % is made to react upon the mixture:</td></tr>
<tr><td colspan="3">a portion is dissolved</td><td colspan="4">a portion remains undissolved</td><td colspan="3">the whole is dissolved</td></tr>
<tr><td colspan="10">Zinc chloride solution is made to react:</td></tr>
<tr><td>dissolves the whole</td><td>dissolves part</td><td>dissolves nothing</td><td colspan="4">dissolves nothing</td><td colspan="2">dissolves part</td><td>dissolves nothing</td></tr>
<tr><td rowspan="7">The alkaline solution does not turn black when acetate of lead is added. Silk.</td><td rowspan="7">The soluble part does not turn black with acetate of lead, the insoluble part turns black: Silk and Wool.</td><td rowspan="7">The mixture turns black with acetate of lead: Wool.</td><td colspan="4">Chlorine water, also ammonia</td><td colspan="2">By Acetate of Lead a portion</td><td rowspan="7">Nitric acid colours part yellow: the remaining part is left white: Mixture of Flax and Cotton.</td></tr>
<tr><td>colour the fibre redbrown</td><td colspan="3">do not colour the fibre</td><td>will turn black</td><td>will not turn black</td></tr>
<tr><td rowspan="5">The fibre turns red with nitric acid. New Zealand Flax</td><td colspan="3">Alcoholic fuchsine solution colours the fibre</td><td rowspan="5">Caustic potash dissolves partly the fibres left undissolved in the zinc chloride. The remaining fibres dissolve in ammonia copper oxide: Mixture of Wool, Silk and Cotton.</td><td rowspan="5">Picric acid colours part yellow: the remaining part is left white: Silk and Cotton.</td></tr>
<tr><td colspan="2">permanently</td><td>the colouring can be washed out</td></tr>
<tr><td colspan="2">Caustic potash colours yellow</td><td rowspan="3">Caustic potash does not colour yellow: Cotton.</td></tr>
<tr><td colspan="2">Jodine and sulphuric acid colour:</td></tr>
<tr><td>yellow: Hemp</td><td>blue Flax</td></tr>
</table>

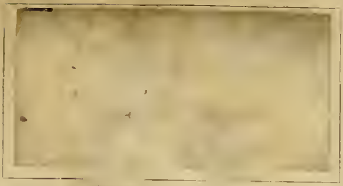
Recent Methods for Distinguishing Flax from Cotton.

According to A. Herzog a piece of the fabric, 4 ☐ cms in size, is put into a tepid solution of Cyanine (Chinoline Blue) and left therein for a few minutes. It is then rinsed with water and treated with diluted sulphuric acid, whereby the cotton is completely decolorised, whereas the flax fibre retains a distinct blueish tint which even darkens if, after the sulphuric acid bath has been washed out, the cloth is put into ammonia.

Another method for testing, by H. Behrens, consists in dyeing the fabric with Methylene Blue in a warm bath; continued rinsing totally removes the colour from cotton, whereas the flax fibre remains distinctly blue. At a previous stage, cotton shows a greenish blue colour different from that of the flax fibre.

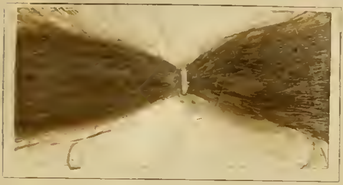
◆

VEGETABLE FIBRES IN THE RAW STATE.

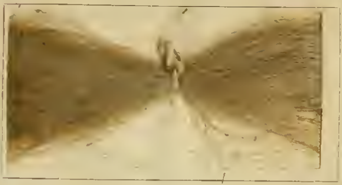


American Cotton.

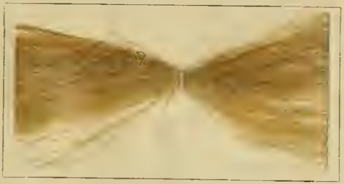
Egyptian Cotton.



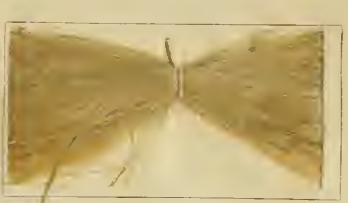
German Flax.



Italian Flax.



German Hemp.



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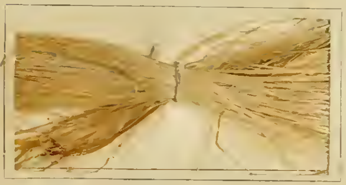

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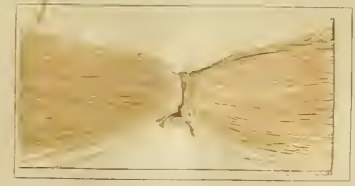
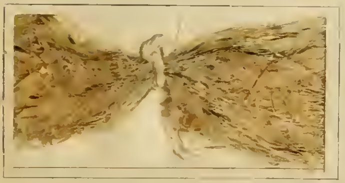
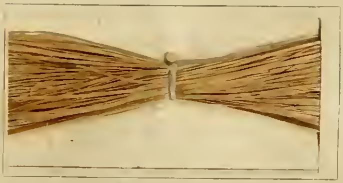


Manilla Hemp.

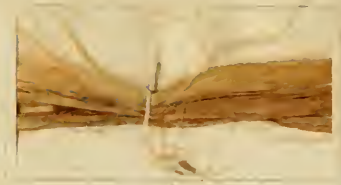


Bengal Hemp.

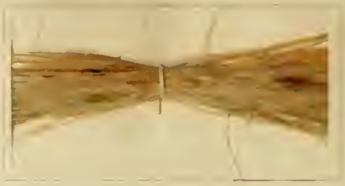


Mauritius Hemp.

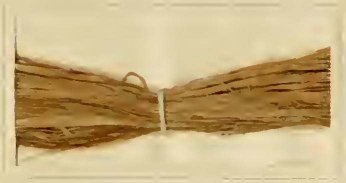
VEGETABLE FIBRES IN THE RAW STATE.



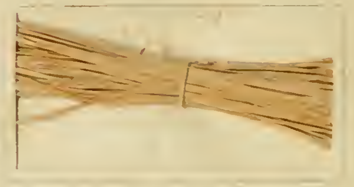
Jute.



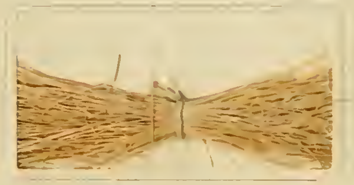
Hankow Jute.



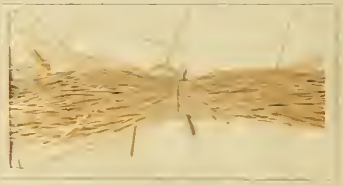
Ramie.



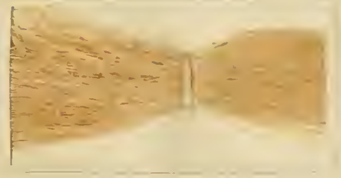
Rafia Straw.



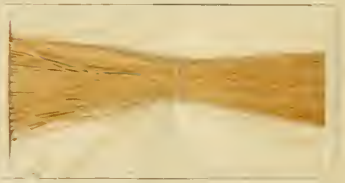
Mexican Sisal.



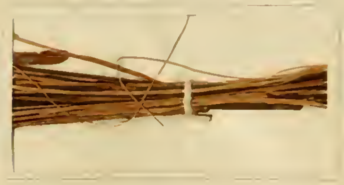
Indian Sisal.



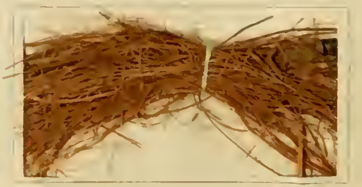
Manilla Fibre.



Mexican Fibre.



Piassava.



Coir (Cocoa Fibre)

a) Flax or Linen.

Linen is prepared for dyeing either by boiling or bleaching. The latter is much more complicated and takes up much more time than the bleaching of cotton. Whilst here there are on an average 5 % of extraneous matter to be removed, the perfect bleaching of linen involves a loss in weight up to 30 %. Besides, the brown dyed pectinal substances of linen adhere far more obstinately to the fibre. And, furthermore, the linen fibre is more susceptible to the reaction of alkalies and acids, so that great care has to be exercised in the bleaching process. Before all, only weak chlorine and acid baths may be used; sodium chloride takes the place of chloride of lime. Only by reiterated treatment with diluted lyes, acids etc. can bleaching be effected without weakening the fibre.

Linen is dyed in the same manner as cotton. Owing to the greater hardness of the linen fibre, the dyeing through is more difficult than in the case of cotton. A thorough boiling of the linen with 5—10 % soda, if necessary, with the addition of soap, is therefore advisable in most cases.

In dyeing with Basic Colours the tannating must be done as hot as possible, and acetic acid or alum added to the dyebath.

In dyeing with Direct Colours it is advisable to add some Turkey red oil to the dyebath, and to work with only small quantities of salts, if required, by increasing the addition of soda, in order to ensure the slowest possible exhaustion of colour.

The Thiogene Colours are also best dyed with the addition of Turkey red oil and rather larger quantities of sodium sulphide than are used for cotton.

The principal linen goods are those blue materials used for workmen's clothing, generally dyed with Indigo. Where there is a question of more thorough dyeing, it is necessary to operate on the sinking frame, and on the zinc-lime or the vitriol vat. For continuous dyeing the hydrosulphite vat is used.

In addition to Indigo, Thiogene Blue B has been favoured for blue dyeing in consequence of its simple manipulation.

Linen is also employed in the manufacture of Plush, Bookbinding cloths ladies' dress goods, etc.

The same directions for dyeing apply to Half Linen fabrics.

Recipes for page 93.

(Compare page 7 and 91.)

1.

Indigo MLB paste 20 %.

2.

Thiogene Blue B.

3.

Dyed in the cistern.
3 % Oxydianil Yellow G
0,35 % Dianil Blue H 6 G.

4.

Dyed in the cistern.
3,5 % Dianil Fast Red PH.

5.

2 % Dianil Green B
0,3 % Dianil Black CR.

6.

2 % Patent Dianil Black FF conc.

7.

Jute Linen.
2,5 % Dianil Green G.

8.

2 % Dianil Green B
0,5 % Dianil Black ES.

LINEN FABRICS.

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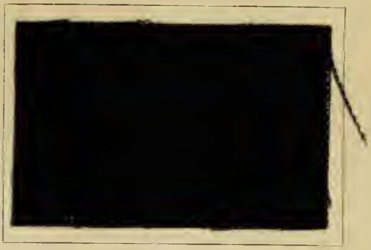

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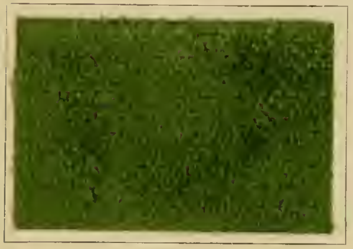

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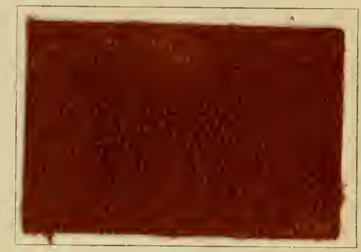

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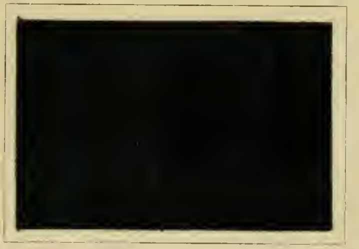

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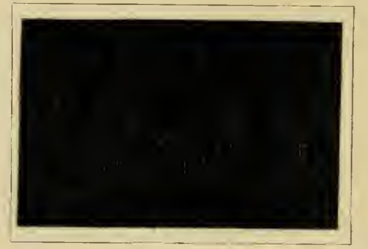

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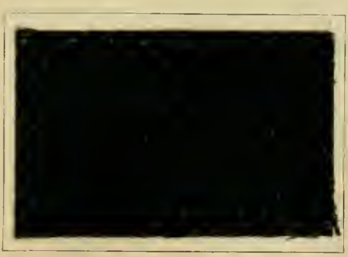

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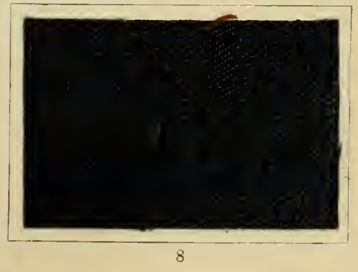


8

Recipes for page 95.

1.

0,07 % Dianil Fast Scarlet 8BS.

2.

Half Linen.

Warp: Linen.
Weft: Cotton, dyed with Para Red.

3.

Half Linen.

Warp: Linen.
Weft: Cotton dyed with
12 % Thiogene Black BRR liquid.

4.

0,25 % Oxydianil Yellow O
0,125 % Dianil Azurine G
aftertreated with
1 % copper vitriol
2 % acetic acid (12° Tw).

5.

1,5 % Thiogene Blue 2R
1,5 % Thiogene Cyanine O.

6.

10 % Thiogene Cyanine G.

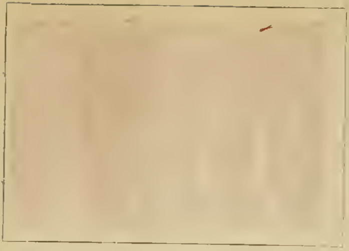
7.

0,25 % Dianil Blue H6G.

8.

0,8 % Dianil Blue BX.

LINEN DRESS STUFFS.



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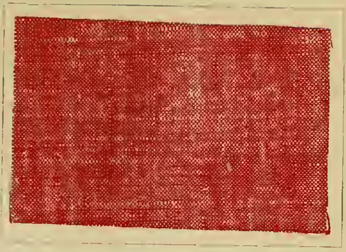

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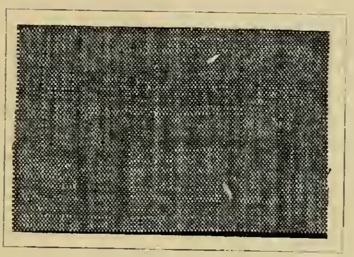

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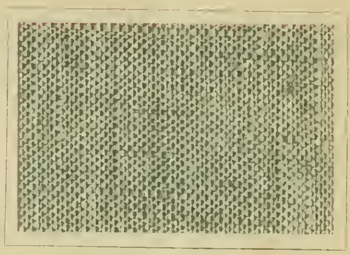

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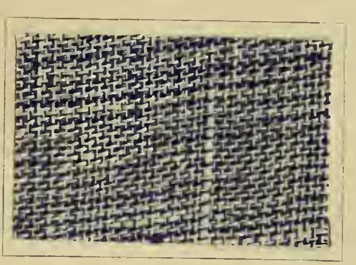

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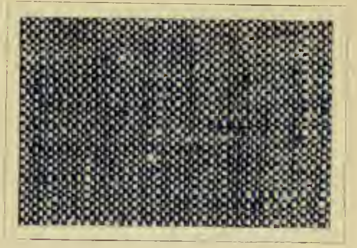

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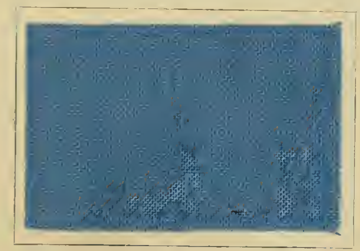

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b) Hemp.

Hemp resembles flax in its behaviour to chemicals and dyestuffs. Its chief use is for the manufacture of twine, rope, sailcloth, and bagging.

Hemp is generally only half bleached, even for light shades. It is soaked in a solution of 2—3 % water glass and then boiled in water. Soaking in a very weak clear solution of chloride of lime and subsequent very weak acidifying with muriatic acid completes the bleaching operation.

The basic colours are dyed on tannin-antimony mordant or direct in a weak acid bath.

c) Jute.

In its behaviour in dyeing Jute stands between wool and cotton. Owing to the tannin incrustations which cover it, jute is capable of fixing basic dyestuffs direct, without previous mordanting. It is mainly employed in the manufacture of coarse fabrics, bagging, curtains and carpets.

The faultless bleaching of jute is still an unsolved problem. Owing to its great capability of reaction the jute fibre is weakened by most bleaching substances; great care is therefore necessary in the employment of chlorine preparations. On examination of a number of proposed methods the following, by A. Busch, is to be recommended.

1. Soaking in warm water overnight.
2. Boiling with 5 grs soda per litre water for ½ hour.
3. Putting into chloride of lime solution ½ ° Bé (1 ° Tw) for 10 hours, and wringing out.
4. Putting into muriatic acid ½ ° Bé (1 ° Tw) for 1 hour, and washing well.
5. Putting into permanganate of potash 2,5 grs per litre for 1 hour, and rinsing.
6. Putting for ½ hour into a solution of bisulphite containing 80 cc 38 ° Bé (72 ° Tw) per litre.
7. Washing, blueing, soaping.

For most purposes of dyeing half bleaching is sufficient; jute is also frequently dyed in the raw state, or after being cleansed with soda.

For jute dyeing the basic, Dianil and Thiogene Colours are suitable. In addition to these there are also used acid Wool Colours (not mentioned in the tabulated synopsis of vol. I) for dyeing jute and other vegetable fibres.

Basic Colours

are dyed with 5—10 % alum. The goods are entered cold, the temperature is raised to 158—176 ° F within ½ hour, and manipulated for about 20 minutes at the same temperature. Dyeing at the boil increases the fastness, but somewhat dulls the brightness of the colours.

Rhodamines are dyed without alum in a bath of Glauber's salt or common salt of 5—7 %.

Dianil Colours

are dyed at a temperature of 176—194° F, with the addition of 20—40 % crystallized Glauber's salt and 1—2 % soda calc.

Thiogene Colours

are dyed after the method prescribed for cotton, which see.

Acid Colours

are dyed same as basic colours. An addition of 2—3 % oxalic acid makes the shades of Acid Violet more fiery. The undermentioned acid colours are suitable for jute dyeing:

Scarlet, all brands,
Fast Red O,
Brilliant Croceine, all brands,
Orange No. 2, No. 4, G,
Brilliant Orange G, R,
Azo Yellow conc.,
Chinoline Yellow O,
New Yellow H,
Flavazine L,
Metanil Yellow extra,
Opal Blue, all brands,
Fast Blue O, soluble in water,
Acid Violet, all brands,
Acid Green conc.,
Naphthalene Green conc.,
Fast Brown O,
Azo Brown V.

Recipes for page 99.

1.

Blue: 1,25 % Conc. cotton Blue No. 1
10 % alum.
Red: 4 % Brilliant Croceine B
10 % alum.

2.

Black: 1 % Jute Black O
10 % alum.
Red: 4 % Brilliant Croceine 2B
10 % alum.

3.

2 % Oxydianil Yellow O.

4.

4 % Dianil Crimson G.

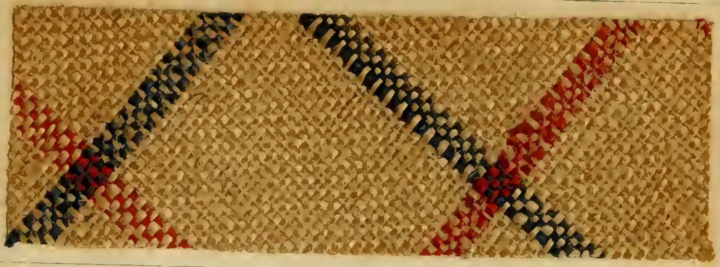
5.

1,2 % Thiogene Green BL extra
2.5 % Thiogene Cyanine G.

6.

16 % Thiogene Green BL extra
0,8 % Thiogene Brown GC.

JUTE FABRICS.



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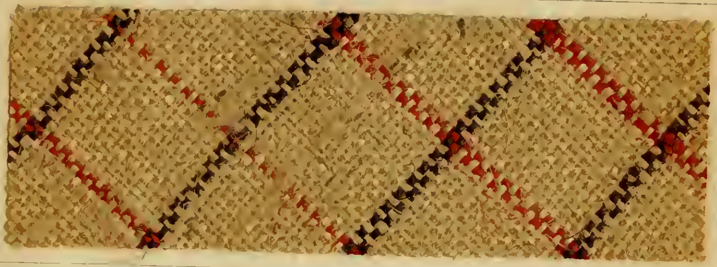

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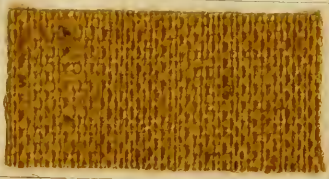

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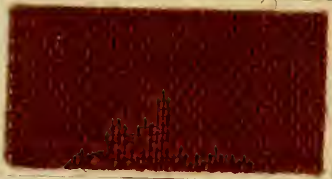

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d) Ramie.

The Indian Nettle fibre, Ramie or Rhea, and Chinagrass, imported from China, greatly resemble cotton in respect of their behaviour in dyeing. For dyeing these fibres basic colours on tannin tartar emetic mordant, also Dianil and Thiogene Colours are used. As Ramie is put white on the market, it is sufficient to wet it before dyeing in a weak soda bath at 140—176° F.

Ramie yarns are manufactured into lace, veils, passementerie of all kinds, carpets, curtains etc.

e) Cocoa Fibre (Coir).

For dyeing cocoa fibre the same dyestuffs and methods can be used as for jute (compare page 96).

The cocoa fibre is brought into the boiling dyebath either direct, or after a previous passage through a soda solution of 1 %. Its use is chiefly for carpets, runners etc.

f) Fibre, Sisal etc.

These substances which are used for upholstering and brush materials, are mostly dyed black, for which the direct Patent Dianil Black brands are suitable. The bath is prepared with about 3 % dyestuff, 2 % ammonia, 0,5 % soda and 5 % Glauber's salt; the goods are entered at the boil and left at that temperature for 1 hour. They are then worked for another ½ hour without steam, rinsed and dried.

g) Straw.

The straw is boiled in water free from lime for 1½—2 hours before dyeing. The boiled material is entered cold; the temperature is raised to the boil within ¾ hours, and the material boiled for another hour. If the water contains lime, a corresponding addition of acetic acid must be made.

The following dyestuffs are suitable for straw dyeing:

Auramine conc., O, I, II,
Phosphine extra, O,
Leather Yellow O, G, GG, 3G,
Leather Red O, G, R,
Leather Brown O,
Chrysoidine A cryst., C cryst., C extra cryst.,
Vesuvine, all brands,
Magenta, all brands,
Cerise G, R,
Grenadine O, R, RR,
Marroon O, extra,
Cardinal G, R,
New Magenta O,
Methylene Violet 3RA extra, RRN, BN,
Safranine GGS, AN extra, O, conc.,
Brilliant Green cryst. extra,
Malachite Green cryst. extra,
Methyl Violet, all brands,
Methylene Blue, all brands,
Methylene Green, all brands,
New Fast Blue 3R cryst.,
Fast Blue for Cotton, all brands,
Rosazeine O, B, extra, B extra, 4G, 4G extra,
Janus Yellow, G, R,
Janus Red B,

Janus Blue B,
Janus Green G,
Janus Brown B, R,
Janus Black I,
Leather Black T, TM, No. 5068,
Coal Black, all brands,
Azo Yellow conc.,
Orange No. 4.

h) Wood and Bast.

Wood and bast are dyed in a similar manner to jute. Basic colours are principally used and dyed in a neutral bath at 158—176 ^{0} F.

Eosines are dyed with very small quantities of acetic acid.

Brilliant Croceine, Rosaniline Blue, Soluble Blue and Pure Blue are dyed with an addition of 2—4 $^0/_0$ alum.

Dianil Colours are dyed at 158—176 ^{0} F, with an addition of 25 $^0/_0$ Glauber's salt; Thiogene Colours after the known rules of cotton dyeing.

i) Flowers and Grasses.

Flowers, leaves, grasses, palm leaves etc. are dyed at the boil in a neutral or weak acid bath. Care must be taken that the dyebath does not bubble, as the materials would thereby suffer or even be destroyed.

The following colours are used for the neutral bath:

Auramine conc., O, I, II,
Chrysoidine A cryst., C cryst., C extra cryst.,
Vesuvine 4BG conc., 3R superior,
Phosphine extra, O,
Leather Yellow O, G, GG,
Leather Red O, G, R,
Leather Brown O,
Flavophosphine, all brands,
Azophosphine GO, BRO,
Magenta large cryst., small cryst.,
Cerise G, R,
Grenadine O, R, RR,
Russia Red D, 5001,
Marroon O, extra,
Cardinal G, R,
New Magenta O,
Safranine conc. O,
Methylene Violet 3RA extra, RRA, BN,
Fluorescent Violet B conc.,
Methyl Violet, all brands,
Malachite Green cryst. extra,
Brilliant Green cryst. extra,
Methylene Blue, all brands,
Methylene Green, all brands,
Coal Black II,
New Fast Blue 3R cryst.,
Fast Blue for Cotton R, BB,
Janus Yellow G, R,
Janus Red B,
Janus Brown R,
Janus Blue G, B, R,
Janus Green G, B,
Janus Black O, I, II.

The following colours are used for the acetic acid bath:

Chinoline Yellow O,
Naphthol Yellow SL,
Acid Magenta extra,
Orseilline R, B,
Acid Crimson O,
Acid Marroon O,
Opal Blue blueish,
Bleu de Lyon RR conc.,
Cotton Blue No. 2,
China Blue No. 2,
Acid Green conc.,
Naphthalene Green V, conc.,
Patent Blue V, A.

Recipes for page 103.

1.

0,02 % Thionine Blue GO.

2.

0,02 % Rosazeine 4 G.

3.

0,2 % Aurophenine O.

4.

4 % Dianil Pure Yellow HS.
1,5 % Dianil Green G,
topped with
1 % Methylene Yellow H.

5.

3 % Methylene Yellow H.
2 % Brilliant Green cryst. extra

6.

2 % Dianil Brown 3 GO.

7.

1,5 % Rosazeine Scarlet G.

8.

4 % Dianil Black ES,
topped with
1 % Methylene Blue BB conc.

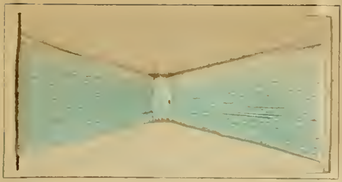
9.

25 % Thiogene Black M liquid
(initial bath).

10.

10 % Thiogene Brown G 2 R.

RAMIE YARNS.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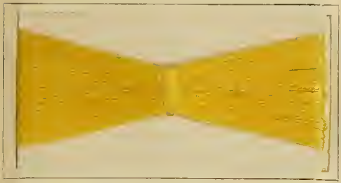
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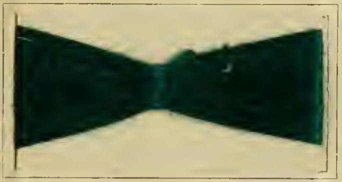
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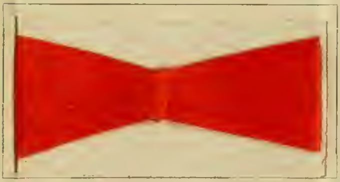
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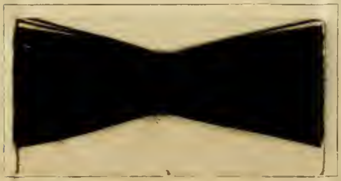
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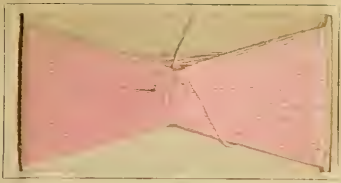
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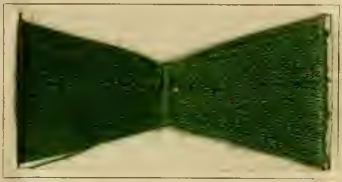
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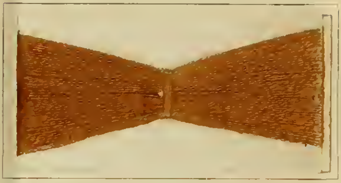
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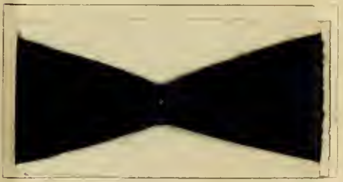
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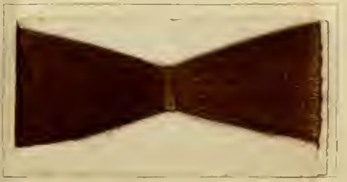
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Recipes for page 105.

1.

Hemp Yarn.

2 % Dianil Japonine G
0,25 % Dianil Green G.

2.

Hemp Yarn.

2 % Safranine conc.
0,25 % New Magenta O.

3.

Hemp Yarn.

0,7 % Conc. Cotton Blue I.

4.

Hemp Yarn.

1 % Dianil Japonine G
0,3 % Dianil Green B.

5.

Cocoa Fibre.

0,2 % Auramine O
5 % acetic acid 8° Bé (12° Tw.)

6.

Cocoa Fibre.

12 % Brilliant Croceine 3 B
10 % Alum
(initial bath).

7.

Cocoa Fibre.

0,4 % Auramine O
0,1 % Brilliant Green cryst. extra
5 % acetic acid 8° Bé (12° Tw.)

8.

Cocoa Fibre.

2 % Coal Black II
1 % acetic acid 8° Bé (12° Tw.).

9.

Fibre.

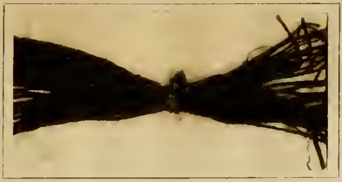
3 % Patent Dianil Black EB conc.
2 % ammonia
0,5 % soda
5 % Glauber's salt.

10.

Sisal Hemp

same as No. 9.

HEMP, COCOA, FIBRE AND SISAL.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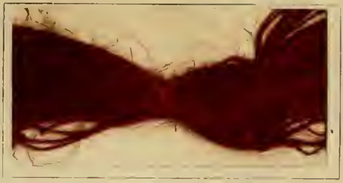
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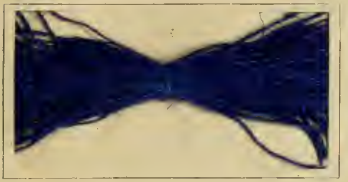
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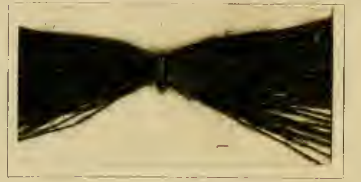
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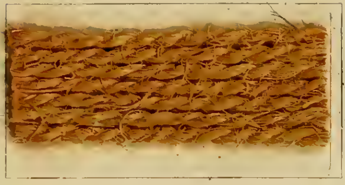
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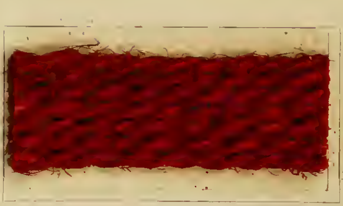
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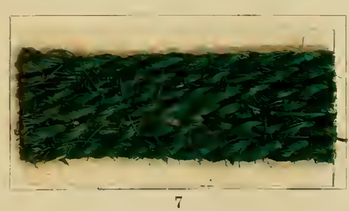
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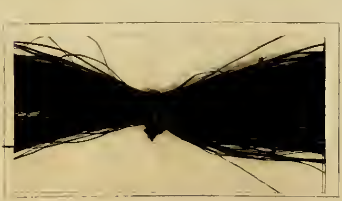
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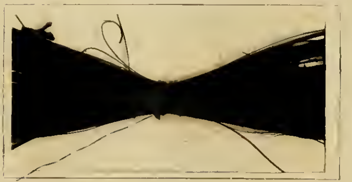
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Recipes for page 107.

1.

Straw.

1,6 % Leather Yellow O,
0,03 % Brilliant Green cryst. extra
0,3 % Leather Brown O.

2.

Straw.

1,5 % Methylene Violet RRA powder.

3.

Straw.

0,7 % Methyl Violet 6B
0,1 % Methyl Violet B,
0,2 % Brilliant Green cryst. extra.

4.

Straw.

3 % Coal Black No. 2.

5.

Bast.

0,75 % Azo Yellow conc.

6.

Bast.

0,04 % Cutch Brown D
0,005 % Safranine conc.

7.

Bast.

1 % Methylene Blue R.

8.

Bast.

0,036 % Safranine conc.

9.

Esparto.

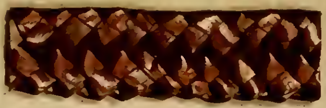
1 % Malachite Green cryst. extra
1,5 % Auramine conc.

10.

Esparto.

5,5 % Rosazeine O
0,5 % Auramine conc.

STRAW, BAST, ESPARTO.



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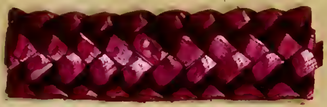

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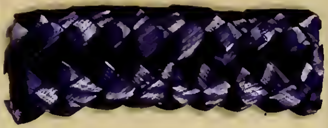

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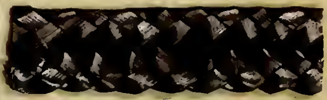

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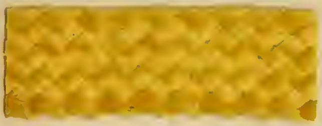

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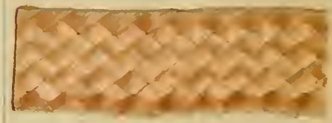

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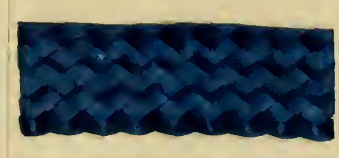

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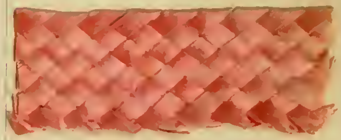

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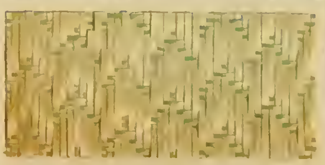

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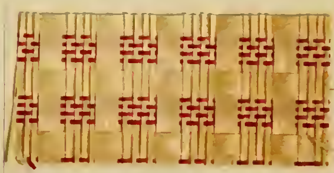

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k. Artificial Silk.

Artificial silk is wetted, before dyeing, in water of 86—95° F.

The Basic or Janus Colours are dyed for an hour in a neutral bath, either cold or up to 104° F, to which the dyestuff is added in 3 or 4 portions. Dianil Colours are dyed with an addition of 10—15% common salt for light and medium shades, and of 20—25% common salt for dark shades. The temperature of the bath is gradually raised to 158° F and the dyeing completed in an hour.

Basic Colours are dyed without preceding mordanting, although it is advisable to mordant first with tannin antimony salt when greater fastness to washing and light is required.

Thiogene Colours are dyed in an hour at 122—140° F, after the customary method.

After dyeing, the goods are rinsed and hydroextracted. Artificial silk which, in the wet state, loses some of its firmness, must be carefully handled in the bath, and must not be wound off after dyeing.

The dyeing of Gloss Materials with basic colours necessitates previous mordanting with tannin and salt of antimony, just as in cotton dyeing. Janus Colours dye Gloss materials without previous mordanting.

The dyestuffs suitable for artificial silk are:

1. Dyestuffs for neutral bath (for Gloss material on tannin antimony mordant):

Auramine, all brands,
Flavophosphine, all brands,
Phosphine new,
Methylene Yellow H,
Chrysoidine, all brands,
Vesuvine, all brands,
Magenta, all brands,
Maroon O,
Cerise G,
Grenadine O,
New Magenta O,
Safranine, all brands,
Malachite Green cryst. extra,
Brilliant Green cryst. extra,
Methylene Blue, all brands,
Methylene Green, all brands,
Primula R,
Methylene Violet, all brands,
Rosolane, all brands,
Methyl Violet, all brands,
Violett cryst. O,
Methylene Grey, all brands,
Victoria Blue B, R, 4R,
Rosazeine, all brands,
Janus Yellow, G, R,
Janus Red B,
Janus Brown R,
Janus Blue G, R,
Janus Green G, B,
Janus Black I.

2. Dyestuffs for the Common Salt Bath:

Dianil Pure Yellow HS,
Dianil Yellow 3G, R, 2R,
Dianil Direct Yellow S,
Oxydianil Yellow O,
Aurophenine O,
Cresotine Yellow G,
Dianil Orange G, N,
Toluylene Orange R,

Dianil Pink BD,
Dianil Fast Red PH,
Dianil Fast Scarlet 4BS, 8BS,
Dianil Red R, 4B, 10B,
Dianil Claret Red B, G,
Dianil Blue, all brands,
Dianil Azurine G,
Dianil Darkblue R, 3R,
Dianil Violet H,
Dianil Brown 3GO, R, BD,
Dianil Fast Brown B, R,
Dianil Brown MH, BH,
Dianil Black, all brands,
Patent Dianil Black, all brands.

3. Dyestuffs for the common salt bath, with the addition of sodium sulphide and soda:

All Thiogene Colours.

1. Paper-Yarns and Fabrics.

These yarns, commercially known as cellulose yarn, xyloline, silvaline, licella, artificial jute etc., are spun on specially constructed machines from diverse paper materials, notably from wood cellulose. They are woven either by themselves or with cotton, jute, linen etc., into sacks, runners, wall hangings, cheap dress goods, sporting cloths etc.

The yarns are chiefly dyed in bulk (in the beating engine), for which the Dianil Colours are specially adapted.

Raw yarns on cops can be dyed in the apparatus, woven fabrics on the jigger. The dyestuffs recommended for cotton, jute and linen, are suitable for these articles.

Recipes for page 111.

1.

Artificial Silk.

0,03 % Aurophenine O
0,015 % Phosphine O.

2.

Gloss Material.

0,012 % Rosazeine B.

3.

Artificial Silk.

0,01 % Methyl Violet 4 R
0,0075 % Methyl Violet B.

4.

Gloss Material.

2,5 % Dianil Blue B.

5.

Artificial Silk.

2 % Safranine AN extra.

6.

Gloss Material.

3 % Janus Black I.

Cotton with Artificial Silk.

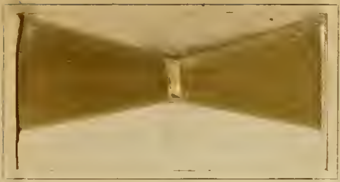
7.

8 % Thiogene Brown GC.

8.

2 % Thiogene Green BL extra
1 % Thiogene Brown GC
0,7 % Thiogene Black MM conc.

ARTIFICIAL SILK.



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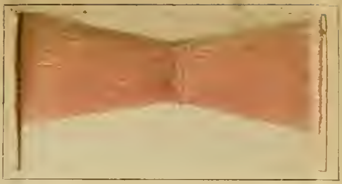

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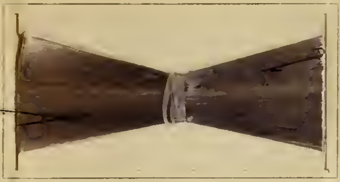

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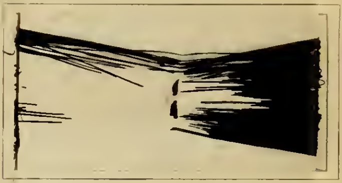

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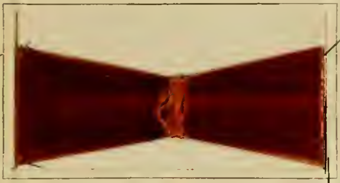

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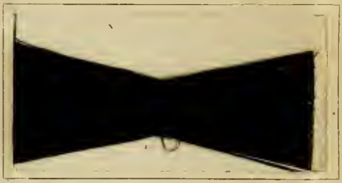

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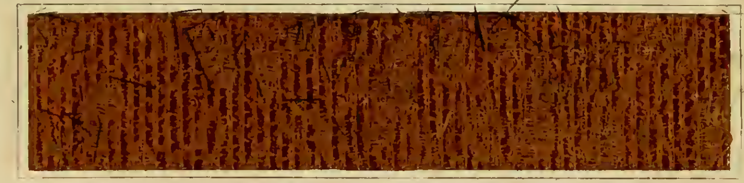

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8

Recipes for page 113.

The yarns No. 1—6 were dyed in bulk (in the beating engine), the woven fabrics on the jigger.

(Compare page 120.)

1.

0,25 % Jet Black for Paper conc.
0,15 % Dianil Brown GG
0,12 % Dianil Orange G.

2.

3,5 % Jet Black for Paper conc.
0,25 % Dianil Yellow G
0,75 % Dianil Blue RR
10 % Glauber's salt
4 % soda
2 % alum.

3.

1,5 % Dianil Crimson B
1,5 % Dianil Red 4 B
4 % soda.

4.

1,8 % Dianil Brown GG
1,2 % Dianil Orange G
10 % Glauber's salt
4 % soda.

5.

2,5 % Dianil Yellow G
0,5 % Dianil Blue RR
0,05 % Malachite Green cryst. extra
2 % alum.

6.

1,75 % Dianil Azurine G
0,8 % Direct Black II
1,2 % Dianil Blue G
10 % Glauber's salt
4 % soda.

7.

3 % Aurophenine O.

8.

10 % Thiogene Brown GRR.

9.

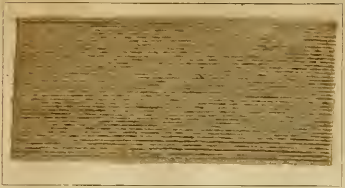
4 % Dianil Fast Red PH
2 % Dianil Claret Red G.

10.

20 % Thiogene Black BRR liquid.

NB. The paper yarns have been supplied by the „Süddeutsche Jute-Industrie“ Waldhof near Mannheim.

PAPER YARNS AND FABRICS.



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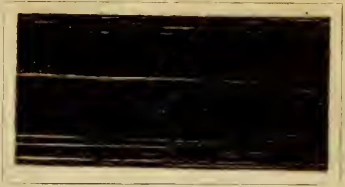

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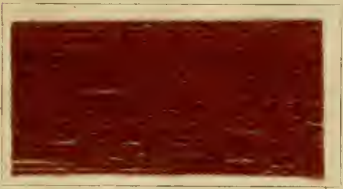

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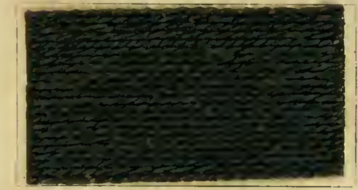

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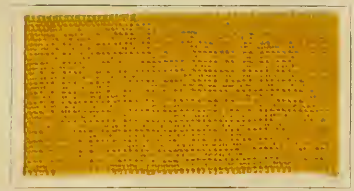

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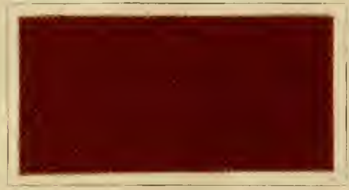

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PART IV.

BLEACHING, MERCERIZING, CHEMICALS AND SUNDRY TABLES.

I. The Bleaching of Cotton.

Bleaching is one of the most important preparatory operations in dyeing and printing. Its object is to destroy certain natural colouring matters of the cotton fibre, or foreign substances mechanically fixed on the fibre during the process of spinning and weaving.

A. Loose Cotton

is rarely bleached for dyeing purposes. Bleached loose cotton is mostly used white, e. g. as melange in yarns, as cotton wool etc.

The cotton is boiled, carefully and under slight pressure, with soda lye or soda in lead-lined iron vessels with removable lids for greater convenience of entering and withdrawing the material. The further treatment, such as rinsing, souring and chemicking etc. is carried out in the same vessel, which, for this purpose, is fitted with a pump.

In many cases open wooden cisterns are used for bleaching. These, if made of good pitchpine staves, last about five years.

B. Roving.

Cotton roving is conveniently bleached in mechanical apparatus after the packing system. The cotton remains in the apparatus until all bleaching operations are completed. For this reason these installations must be constructed of such materials as will resist the action of alkalies, acids and hypochlorous acid salts, for which purpose hard lead and gun metal are most suitable.

On the average 3% calc. soda (of the weight of the cotton) is used for boiling, and about $^1/_4$% soap or Turkey red oil is added. After boiling the material is rinsed in the lead-lined vessel and chemicked with sodium hypochlorite of $^1/_2$—1° Tw (Chloride of soda). After a second washing it is soured with sulphuric acid of 1° Tw, to which has been added some Methylene Blue, for blueing the material. It is then thoroughly washed, hydroextracted, and finally dried.

Operating with sodium hypochlorite (chloride of soda) instead of chloride of lime though rather more expensive, has many advantages, on account of its greater solubility and more energetic bleaching power.

Chloride of soda is produced either by electrolysis of common salt, by means of so-called electrolysers, or by reaction of soda upon chloride of lime. For its preparation see page 153.

C. Cotton Yarn Bleaching

has become of greater importance than the bleaching of loose cotton. According to the purpose for which the yarn is intended, 3 different applications are to be considered.

The yarn comes into the market either white, in which case it is usually blued and soaped after bleaching, so as to impart to it a soft feel and clear colour. Or the yarn is bleached, for the purpose of being woven together with dyed yarn. Or else it is bleached preparatory to dyeing and printing. As in dyeing, so also in bleaching the yarn is subjected to the varions bleaching operations, be it in the hank, on cops, or cheeses, in the warp either undressed or on the beam; and similar apparatus are used for both processes. The material of the apparatus must, of course, be such as to withstand as much as possible the action of the alkalies and acids, and to exclude all possibility of stains. Recently nickel and nickel compositions have been employed for this purpose with advantage.

Where no pure, full bleach is required, there has been introduced in some cases cold bleaching, by packing the yarns, cops etc into a specially constructed iron receptacle, filling up the intermediate spaces with loose material, and circulating for 4 hours under pressure of $1\frac{1}{2}-2$ atmospheres with a solution of chloride of lime $1\frac{1}{4}^0$ Tw. The yarn is then washed under pressure for 20 minutes, and finally soured with hydrochloric acid of 1^0 Tw in the same manner. After rinsing once more the bleaching is finished.*)

In applying this cold process, the chief object was not, of course, to produce pure cellulose, only a white which would suffice for some purposes of fancy styles weaving. In this manner the onerous and tedious boiling is avoided and consequently the loss of weight considerably lessened.

With the same object another method of bleaching yarn on cops and cheeses has been introduced by F. Erban and L. Pick. By this method the cops etc. are treated on special apparatus for several hours with mixtures of sodium hypochlorite (chloride of soda) and Turkey red oil, or still better with Stockhausen's Monopole soap, which does not form insoluble combinations with lime, and is therefore preferable with hard waters. Thus, after being well rinsed, if necessary, with an addition of some hyposulphite of soda, the yarn is bleached perfectly white. In the inventors' opinion yarns bleached after this method are also suitable for dyeing. Reliable information from practice as to the cost of this process, in comparison with that hitherto in use, is not yet available.

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*) This process has been extended with success by some spinners to rovings. From the material bleached in this manner white cops and cheeses are produced which are suitable for weaving multicoloured fabrics.

The generally adopted mode of yarn bleaching rests on the same principles as that of the bleaching of pieces described further on. But the operation of yarn bleaching is simpler, because in fabrics the obstinately adhering foreign matters introduced in sizing and weaving are to be removed. In many cases boiling with water is sufficient; this can be done in open cisterns, but more economically in kiers under a pressure of about $2-2^1/_2$ atmospheres. Thorough washing is followed by slight souring or, if the yarn is intended for light shades, by chemicking and souring. Another washing completes the bleaching operation. As the cotton does not take up the water freely, additions of soda, soda lye and soaps hasten the thorough boiling. They also react more strongly upon the foreign substances in the cotton; consequently these alkaline baths effect the boiling more easily than water alone. Therefore an often adopted rule for boiling is, to use $3^0/_0$ caustic soda (of the weight of the yarns) with an addition of small quantities of Turkey red oil. This, however, must be varied according to the material and the mechanical appliances available. For the operations of boiling, chemicking and souring, the same rules as further on described for the bleaching of piece goods are applicable.

Generally, the cotton yarns to be boiled are put together loose or tied up in a knot, in single pounds, or put into sacks. They are boiled in the kier for 3—4 hours with clean water, under pressure of 1,5—2 atmospheres; then the steam is turned off and the yellowish coloured water drained away whilst clear cold water is continually let in above. By this means the boiled-off liquid is quickly removed from the yarn, and kier stains avoided. After rinsing the yarns are entered into a clear solution of chloride of lime $^1/_4-1^1/_2{}^0$ Tw, then rinsed again, soured with sulphuric acid, and well washed on the washing machine. Finally they must be carefully dried.

Frequently the yarns are manipulated in such a manner that the single skeins are fastened together chainwise. Some bleaching works have gone a step further, not without success, by carrying out the various operations of boiling, washing, chemicking and souring with such a chain of yarn without interruption, that is to say, in a similar manner to that of warp bleaching.

Of by far the greatest importance in bleaching is:

D. The Bleaching of Cotton Fabrics.

As cotton fabrics contain, — besides the natural impurities and those produced in spinning, — various extraneous matter e. g. size etc., the bleaching process of cotton pieces is considerably more complicated than that of yarns.

The substances employed for sizing cotton warps are for the most part thickenings, starch, dextrine, less frequently glue, fatty substances and magnesia salts.

Previous to bleaching the goods are either singed or cropped, according to their subsequent mode of embellishment.

Singeing.

The object of singeing is to remove the loose hairs, the so-called fluff, from the surface of the cloth, whereas the cropping machines are used for cutting away the more prominent unevennesses, knots etc.

The singeing is effected either on plate, roller or gas singeing machines.

When working on the plate singeing machine, the cloth passes rapidly over two red hot copper or cast iron plates, and then through a water trough in order to extinguish any sparks which may have remained on the cloth. In order to keep the plates always evenly heated, the guide rollers over which the pieces travel are constructed in such a manner as to continually change their position with regard to the plate.

In operating with the roller singeing machine, the cloth passes over a red hot cast iron roller revolving in the opposite direction. By this means the material is continually brought into contact with different parts of the hot roller.

On the gas singeing machine the cloth passes one or more rows of gas jets by which the fluff is singed off. When properly singed the cloth is not impaired.

For heavy goods the plate or roller singeing machine, for light materials the gas singeing machine is preferred.

After singeing and previous to bleaching the goods are gathered into rope form by running through narrow porcelain rings.

Bleaching proper begins with alkali boiling, after the extraneous substances added in weaving have been almost entirely removed from the cloth, i. e. after the goods have been steeped.

Steeping

can be effected by mechanical or by chemical means, and consists in working on washing machines, or in bringing about a slight fermentation by impregnating the cloth with alkaline or acid liquors. Starchy matter is thus rendered soluble and removed for the most part in subsequent washing. The more thoroughly this is done, the easier will be the bleaching process.

The material can be steeped:

1. In cold sulphuric acid of about 3° Tw, it is allowed to lie in this solution for 6—12 hours. (In 1883 H. Koechlin proposed steeping in boiling diluted sulphuric acid.)

2. In a solution of about $^3/_4$ % (of the weight of the material) dry caustic soda at boiling point; it is impregnated and then allowed to lie tightly packed in covered wooden boxes for 24 hours. (This method was proposed by E. Lauber, especially for thick cotton cloths.)

3. In clear lye, previously used, at about 140° F, until a sour smell indicates the commencement of fermentation.

The two latter methods act more strongly upon the husks and seed capsules present in the cotton than the treatment with acid which, on the other hand, when used cold, is easier to manipulate. The soured goods must be interlined with wet packing sheets, in order to prevent their getting dry in places.

Alkali boiling.

The boiling process (boiling in alkali) is the most important operation in bleaching and the final results greatly depend on it.

Fifty years ago, the material was always boiled in open cisterns, but these have now been replaced by closed kiers which permit of boiling the material under pressure. The circulation of the liquor in closed kiers was originally effected by injectors; these sucked the liquid from the lower part of the kier and then showered it over the surface of the goods. By this method of working direct steam was continually entering which gradually condensed to water and thus diluted the alkaline liquid. To obviate this drawback, pumps were introduced (about the middle of the last century), which were driven from without the kier so that the liquid within was kept at a constant concentration. Up to 1882, suction and pressure pumps were used, but then Scheurer-Rott constructed the first rotary pumps, and at the same time invented appliances for superheating the lye. These superheaters make it possible to boil the lye without diluting it. The pumps on the other hand force the liquid through the tubular boiler. The system of pipes in this boiler is surrounded by a casing into which the steam is admitted. The condensed steam runs into a receiver at the base of the boiler.

This construction as shown in fig. 1 is typical for modern bleaching kiers.

Several innovations have been tried from time to time, such as perforated central pipes, perforated double casings inside the kier etc., but as they did not represent any real or vital improvement upon the first model they have been mostly dropped again.

The bottom of the kier is covered with a convex-perforated false bottom, frequently weighted with granite pebbles, upon which the material is laid.

The material is packed in rope form into the kier by experienced workmen, and must fill the interior evenly; it is then covered over with clean canvas, and weighted with well galvanized iron rails. The lye is prepared in a separate vessel and is run into the kier together with water, whilst the pump is in action. The level of the liquid must be about 10—15 inches above the material. It is advisable to filter the whole liquid through a cotton cloth when entering the kier.

The contention that in this manner the alkaline liquid is 'salted out' by the goods, and that consequently the lower layers of the material come into contact with more dilute liquid than the upper layers has never been proved.

The lye which is already warm when entering the kier, is gradually heated to the boil; then, for reasons which will be explained below, some bisulphite is added, the kier lid fastened, and the boiling continued under a pressure of about $2^{1}/_{2}$ atm.

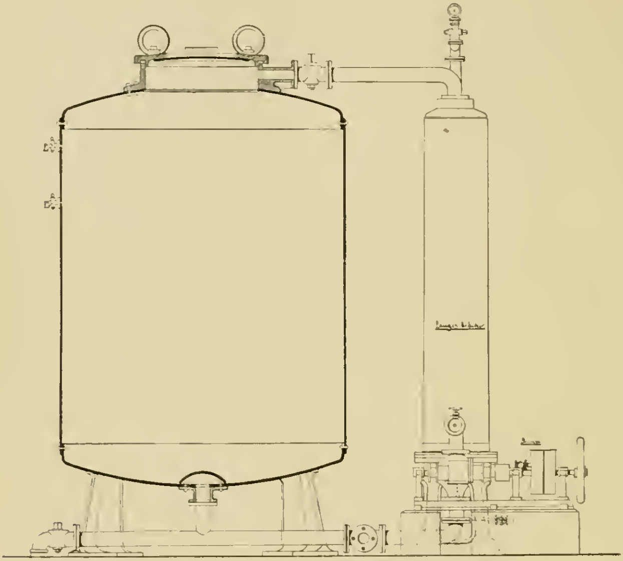


Fig. 1.

Besides the upright kiers of the described or similar constructions, a horizontal kier built by Mather & Platt, Ltd., Manchester, is most largely employed, especially in large print works. This kier was originally intended by Horace Koechlin for a different method of boiling; it had, however, to be modified, so that the boiling in the so-called Mather kier is effected in practically the same manner as in the one described above. The difference lies in the manipulation. The goods are packed into waggons which are bodily run into the horizontal apparatus.

Fig. 2 shows a sectional elevation of the Mather kier.

The steeped and washed material passes through an impregnating machine (constructed like a washing machine), where it is saturated with soda lye (about 1 $^1/_2$ lbs. dry caustic soda for 100 lbs. of material); it is then carefully and tightly packed in the waggons. The waggons are run into the kier and on arriving in their proper position, a spring lever connects the kier with an opening in the bottom of the waggon, through which the liquid circulates as soon as the pump is set in motion. After closing the kier, a solution of resin soap (4 gallons to 100 lbs. of material) is run in from a separate vessel. The soap solution contains 16 lbs. of resin and 22 lbs. caustic soda lumps in 100 gallons.

When all the air is expelled from the kier by steam, the valve is closed and the pump set in motion. For the first hour the goods are boiled under a pressure of $^2/_3$ atm., and then for further 8 hours under a pressure of 1 $^1/_2$ atm. Then the steam is let out and the kier filled $^2/_3$ full of water; this is allowed to circulate for 1 hour, and then let off; this operation is then repeated twice.

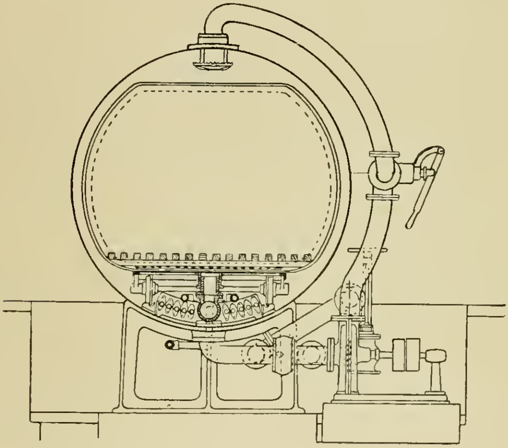


Fig. 2.

A similar kier is that constructed by Thies and Herzig. The principle of this system is to operate in a kier which is free from air. Cotton, treated with caustic soda in the presence of air, is liable to become tender owing to the formation of oxy-cellulose, and for this reason, Horace Koechlin proposed to counteract the oxygen and to render it harmless by means of sodium sulphite. Thies and Herzig on the other hand applied mechanical means for the same purpose, viz. they connected the kier with a special air pump and a separate boiling pan besides the ordinary pump and the superheater. Although the operation of alkaline boiling becomes hereby distinctly more complicated, it assures the entire removal of oxygen, so that stronger lyes can be employed without impairing the strength of the fibre. Naturally this process is more expensive than the ordinary method.

The previously steeped material is packed into the kier and the air at once drawn off by means of an air pump. Then old (previously used) lye is pressed into the kier through a valve in the bottom of the apparatus. The temperature of the lye on entering is about 60°, but it is at once heated up by means of the special heating appliance and circulated through the material for three hours. Then it is drawn off, and the goods are washed with the condensed water which has collected during these operations in the boiling pan. This vessel is now used for preparing a fresh alkaline solution of 6—9° Tw.; the amount of the lye is so regulated that it equals or slightly exceeds the weight of the goods in the kier. This lye is again heated up, the pump set in motion, and the liquid pumped into the kier, where it is worked for about 6 hours under a pressure of 2½ atm. Finally the material is washed with water, heated to 100° F. in the boiling pan.

The duration of the boiling, the pressure under which it is effected, the composition and the concentration of the lye vary according to the nature of the material to be treated and according to the purpose for which the goods are intended.

The higher the pressure, the sooner the process of alkali-boiling is terminated; on the other hand the pressure ought never to exceed 2½ atm., as the cotton fibre is tendered if the temperature rises above 265° F. The duration of the alkali boiling has also an effect upon the results of the bleaching process. On an average, a good circulation of the boiling liquid through the kier for 6 hours will be sufficient, and, if the goods are previously well scoured, the cloth so treated will be suitable for all branches of dyeing and printing.

The comparatively large amount of time, power and steam used is in the first place due to the manner in which the material is laid in the kier. Being packed tightly in rope form, it offers a considerable resistance to the circulating liquid, and it is therefore evident that the operation must be continued longer than theoretically necessary, if each individual lot is to be acted upon evenly in the kier.

Naturally, these circumstances have also a bearing upon the quantity of the material. The greater the quantity of cloth, the more power will be required for boiling it evenly, and the greater will be the danger of being troubled by stains. For this reason it has been the aim of bleachers and constructors of bleaching machinery for many years to build some mechanical installations in which the material could be alkali-boiled in the open. The object of such a construction is, on the one hand, to reduce the length of the operation and, on the other hand, to keep the cloth opened out during the entire process and thus to overcome the difficulty of removing creases, which are often very obdurate in some materials when boiled in rope form.

Fig. 3 illustrates an installation by Endler-Welter (German Pat. 120447) which is suitable for alkali-boiling of light calicos at full width.

This arrangement consists of three connected chambers; the centre one, the steaming box, protrudes into the two adjoining chambers at either end and thus divides these each into two compartments. In the first chamber the cloth runs through the lye, and gets thoroughly saturated with it; it is then guided into the steam box, which it passes in long hanging folds, and is finally washed off in the third chamber. The liquids in the first and third chambers act as hydraulic valves for the central chamber in which a steam pressure of about $^1/_4$ atm. is maintained.

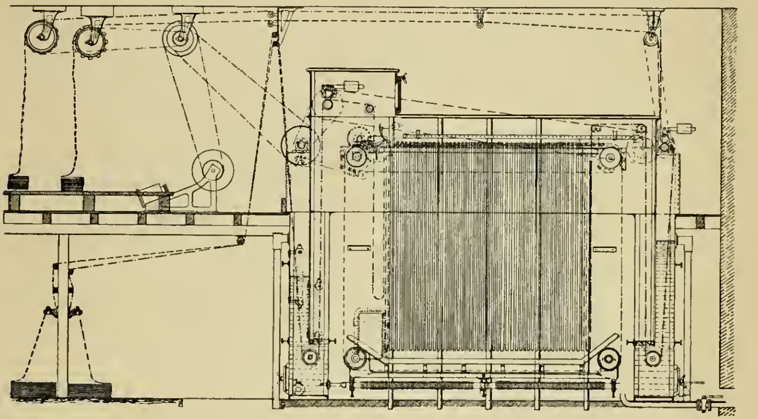


Fig. 3.

The actual process of boiling with alkali is here, therefore, replaced by steaming; the material which is impregnated with soda lye and bisulphite is steamed for varying lengths of time, the latter being regulated by the speed of the machine. The production can be increased by running two or three pieces simultaneously, viz. in double or treble layers, through the machine. For light calicos $1-1^1/_2$ hours steaming will be sufficient, and the necessary amount of chemicals will be approximately $4^1/_2$ lbs. dry caustic soda and 3 nog. bisulphite 52° Tw. per 112 lbs. of material.

After passing through the machine the cloth may be washed either open or in the rope form in the ordinary manner.

Tagliani and Rigamonti improved this system by introducing the so-called collector. The pieces travel in the direction indicated by arrows at full width through the vertical pit, until they arrive at the U-shaped collector in the second compartment, where they are plated down by a self-acting folding appliance. The collector itself consists of an endless chain, which is in constant motion. By this means the material also moves along: it is plated down on the right arm of the collector, travels along the U-shaped space and arrives finally at the left arm of the collector, whence it passes out again through the vertical pit as shewn in sketch 4.

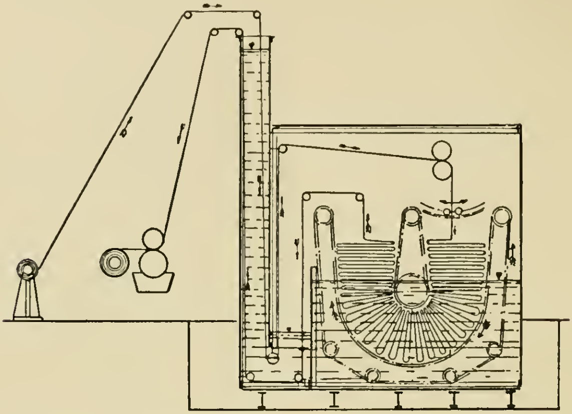


Fig. 4.

It is possible by means of a clever device to feed the collector quite regularly, and also to regulate automatically both the plating down of the cloth and the speed of the travelling chain.

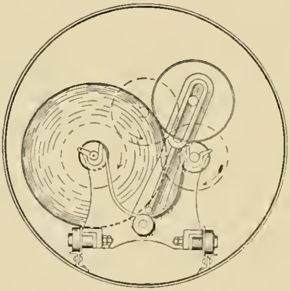


Fig. 5.

The liquid is kept in circulation by means of a pump, and the goods remain $1\frac{1}{2}$—2 hours — according to quality — in the apparatus, which holds from 2—10000 yards.

In both installations which we have described, the steam pressure is gauged by the height of the liquor in the vertical pits; it can never exceed 1 atm. However, this pressure is not sufficient to remove or to destroy all the impurities contained in cotton, and, therefore, kiers were built in which the cloth could be treated in the open in a similar manner as in rope form, in high pressure kiers.

Although the output of these kiers is rather small, still for some purposes they are almost indispensable.

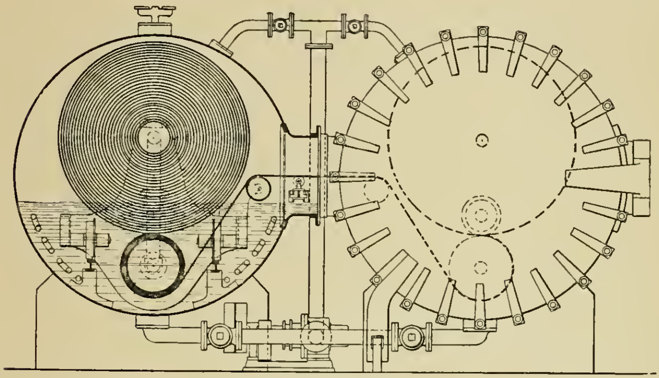


Fig. 6.

The Jackson & Hunt bleaching kier (fig. 5) contains an arrangement by means of which the pieces are treated at full width, in a similar manner to jigger dyeing; they are wound on rollers: unwinding from the one, they are automatically rolled on to the other roller. In order to prevent creases from forming and the selvedges from doubling-up, a cylinder rests loosely upon these rollers and reverses the gear whenever necessary.

The lye sprays over the pieces by means of a pump, whilst they are winding from one roller to the other. The length of this boiling process, also the steam pressure which is applied, can be varied at will. For ordinary cloths 2—3 hours boiling will suffice. The daily output of this kier is, therefore, 4 lots of 2—3000 yards each.

As our sketch (fig. 6) illustrates, the interior of the Jackson & Hunt system is by no means fully occupied. To make use of the whole of the available space and to increase the production a machine was built which consisted of two adjoining horizontal high-pressure boilers, connected with each other by a slit. The pieces are again on rollers, but instead of winding and unwinding within the one boiler, they now unwind from a roller in the one and, passing through the connecting slit, are wound on to the roller in the second boiler.

The pump sprays the lye on to and through the travelling fabric which, when thin enough, can be worked in double or more layers.

Whichever method of boiling is employed, whether in rope form or at full width, the goods must always be thoroughly washed afterwards in order to remove all the substances rendered soluble by the boiling in alkali.

After washing the cloth is either chlorinated or soured, or first soured, then chlorinated and again soured, each operation being followed by washing.

Whichever method is to be adopted, depends on the class of goods and their subsequent treatment. It is impossible to lay down any hard and fast rules.

A final thorough washing is indispensable, for all the mineral acid must be removed, as, in drying, this would concentrate and injure the fibre; it might also affect the shade when dyed.

E. Lauber gives the following directions for bleaching cloths intended for dyeing and printing.

I. HEAVY CLOTHS.

1. Singeing.
2. Passage through a sulphuric acid bath 3° Tw. (allowed to lie 4—5 hours. preferably overnight). Care must be taken not to let it dry.
3. Washing.
4. Boiling: 8—10 hours under 1½ atm. pressure.

For 1000 lbs. material are required:

25 lbs. calc. Caustic Soda,
10 lbs. Solvay Soda,
4 lbs. Castile Soap,
2 lbs. Bisulphite 72° Tw.

5. Washing.
6. Chemicking with clear chloride of lime solution ½—1° Tw.
7. Washing.
8. Souring with sulphuric acid 1½—3° Tw.
9. Final washing.

II. LIGHT CLOTHS.

The bleaching process for light cloths is the same as for heavy cloths, except that less alkali is used in boiling.

For 1000 lbs. of material are required:

22 lbs. dry Caustic Soda,
7 lbs. Solvay Soda,
$3^1/_2$ lbs. Castile Soap,
1 lb. Bisulphite 72° Tw.

III. HEAVY FLANNELLETTES.

1. Impregnating with boiling soda lye (12 lbs. 76° Tw. per 1000 lbs, material). The goods are tightly packed in wooden boxes and kept there well covered for 24 hours.
2. Washing.
3. Boiling: 8—9 hours at $1^1/_2$ atm. pressure.

1000 lbs. material require:

70 lbs. Soda Lye 76° Tw.,
8 lbs. Solvay Soda,
4 lbs. Soap,
$1^1/_2$ lbs. Bisulphite 72° Tw.

The further operations are as described under I.

◆

As special cases applicable to bleaching the following may be mentioned:

1. In bleaching **multicoloured fabrics,** shawls with multicoloured borders etc. special care has to be taken. Before all, the goods must be boiled without pressure, i. e. in an open vessel. Calc. soda must be used instead of caustic soda (not more than $1—1^1/_4$% of the weight of the material). The boiling and subsequent rinsing in the vessel is repeated 2—3 times; the goods are then washed, chlorinated with chloride of lime for $1^1/_2$—2 hours, washed again, passed through a weak antichlor bath, and finally soured with muriatic acid of about 1° Tw. After a short rest the goods are finally washed.

2. For cotton goods intended to be **dyed with Turkey red** chlorinating, if possible, should be dispensed with, as it affects the fulness and beauty of the colours. Only when absolutely necessary, as e. g. in dyeing pink shades, weak chlorine baths are used.

3. **For particularly good whites on goods dyed and printed,** the pieces are always bleached and thoroughly chlorinated before printing.

4. **White materials** require a very thorough bleach, they must not turn yellow in storing. It is advisable to boil them twice, first with lime and then with soda. After chlorinating and washing, they are blued with ultramarine.

It is clear that the bleaching process does not always run smoothly, and it seems advisable, therefore, to refer briefly to some of the causes, the discovery and finally the avoidance of faults in bleaching.

These faults must be classified into: 1. clearly visible and properly defined spots or large undefined coloured blotches, and 2. invisible or scarcely visible stains. Both faults may occur simultaneously, therefore it is necessary, whenever difficulties arise, to ascertain their cause before attempting to remedy them. Attempts to remove stains by strong acid or chlorine are often liable to ruin the material entirely.

If the stains are visible, the bleacher will generally recognize their origin quickly and treat them accordingly. Oil and grease spots, mostly noticeable in the raw material, are removed by a local treatment (rubbing with vegetable oil before bleaching); frequently, however, this treatment is only partially successful. Kier stains are light to dark brown, cloudy stains, caused by deposits if the boiling liquid has circulated irregularly. These stains generally disappear in the subsequent souring and chemicking operations; however, if they are not removed by one operation, the boiling, souring and chemicking with dilute solutions must be repeated.

A further cause of stains is an insufficient washing of the material in the kier. The cloth touching the hot walls of the kier gets dried in parts and this causes stains, especially when lime is used as alkali in the boiling process.

Soap occasionally causes resin stains which offer a stubborn resistance to saponification. Also lye stains are apt to occur by employing a too highly concentrated soda lye; local mercerisation takes place which makes itself disagreeably apparent in dyeing (especially indigo).

Rust stains will appear if the wet material comes into contact with iron. To avoid this, the interior of the kier ought to be coated with lime-wash (thick milk of lime, mixed with albumen). This coat of lime must be perfectly dry before the kier is used.

Rust stains can be removed by a warm solution of oxalic acid and subsequent washing.

Special attention must be paid to the process of chemicking. As a general rule, the material is thoroughly cleansed and appears white before chemicking.

The stronger the chloride of lime solution, the greater is the danger of the oxidation spreading and forming oxycellulose on the fibre.

If cloth which is impregnated with chloride of lime solution is exposed to the action of direct sunlight, or to the air, it is apt to be converted in some parts to oxycellulose, also in drying. These facts must naturally be considered; it is, therefore, advisable to cover the chemicked material with clean packing sheets.

Oxycellulose is also formed when the goods come into contact with metallic iron in the presence of hypochloride solutions. Whilst the iron is converted into its hydroxide, oxygen is liberated and this, acting on the cellulose, forms oxycellulose.

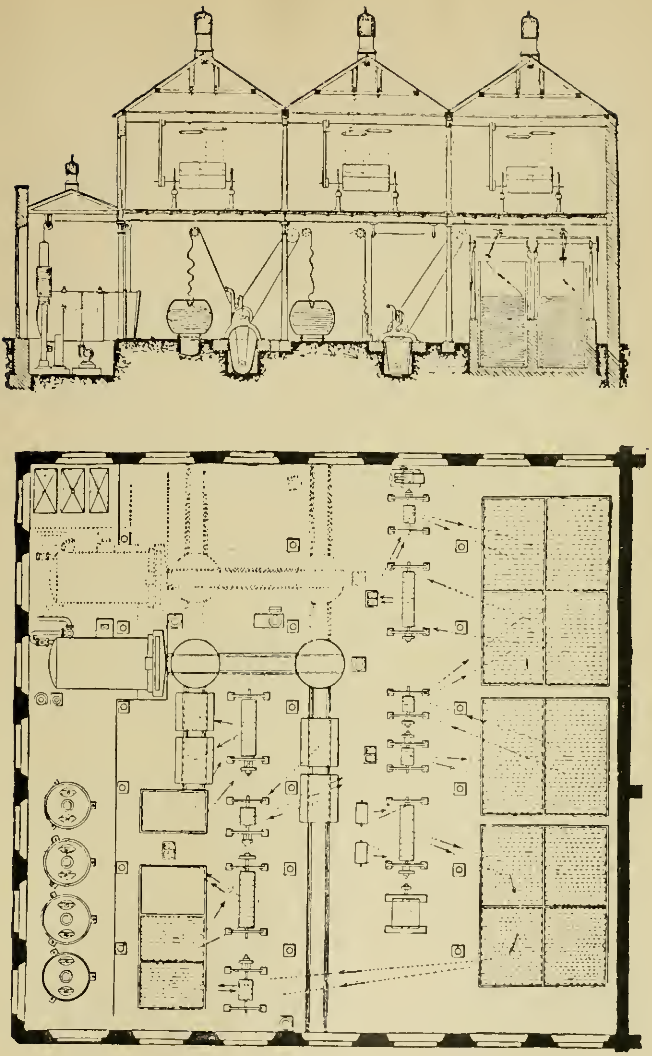


Fig. 7.
Bleaching plant (Mather & Platt Ltd., Manchester).

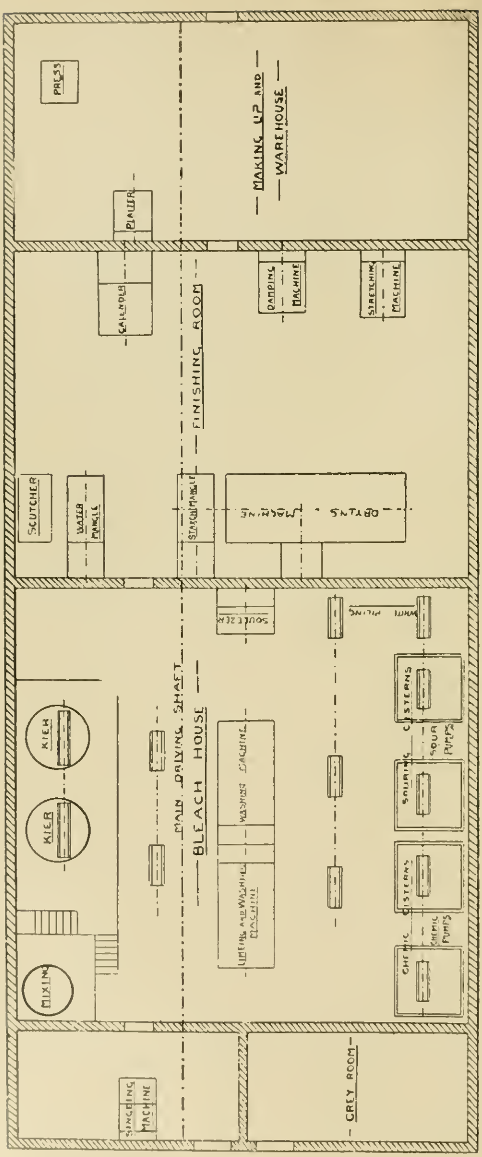


Fig. 8.
Bleaching plant (Sir J. Farmer & Sons Ltd., Manchester).

Oxycellulose stains occur through uneven chemicking, especially if the solution contains undissolved particles which adhere to the cloth; these stains are very clearly to be seen in dyed materials, for they are dyed deeper owing to the greater affinity of the oxycellulose for the dyestuff. Oxycellulose is therefore easily detected by dyeing the material in a dilute solution of Methylene Blue. A further test for oxycellulose is found in its property of reducing "Fehling's solution". After freeing the cloth from all sizing ingredients, it is boiled for ¹/₄ hour on a water bath with 10% Fehling's solution; the presence of oxycellulose is shewn by a red colouring of the cloth owing to the precipitation of cuprous oxide. Oxycellulose stains generally impair the strength of the cotton fibre; in many cases, however, this is not detected until the goods are treated with alkali.

Oxycellulose cannot be removed from

the fibre, as the cotton has undergone a chemical change. Great care must therefore be taken to avoid its formation.

Acid stains result if the pieces, after souring, are insufficiently washed; sometimes also the acid becomes more concentrated, if the wet goods dry in places, and thus the strength of the fibre is impaired. It is advisable to wash thoroughly after souring, and to test the acidity with Congo solution before dyeing.

We conclude our description of bleaching by appending illustrations of bleaching plants of Mather & Platt (Fig. 7) and of Sir James Farmer & Sons Ltd., Manchester (Fig. 8).

* * *

II. MERCERISING OF COTTON FABRICS.

In 1844, John Mercer made the interesting and important discovery that cotton undergoes both physical and chemical changes by the action of caustic solutions. Treated with caustic alkali and then well washed, the cotton fibres change considerably in appearance; they become plastic and show an increased affinity for metallic mordants and for a certain number of dyestuffs. This is due to a hydration of the cellulose. Examined under a microscope, the fibre appears cylindrical, thick, and transparent, whilst the ordinary cotton fibre appears flat and helicoid. Moreover by this treatment the fabrics shrink considerably in length. Mainly for this reason Mercer's observation was not put to any practical use, but in 1890 Lowe, and in 1895 Thomas and Prevost showed that cotton cloth, submitted to the action of soda lye, in a stretched condition attains a silky lustre and does not shrink on leaving the stenter. This process, which immediately found a practical application, was called mercerising. It is of the greatest importance for the textile industry and is to-day employed in almost all print works. The method is simple and inexpensive; it increases the strength and the chemical affinity of the fibre and produces a silky lustre which to a certain degree withstands repeated washing and soaping. The beneficial effect of mercerising on the strength of the fibre is especially important when working with thin materials.

All sorts of cotton can be mercerised, the best effect, however, is obtained on Egyptian cotton, which has the longest staple.

For mercerising, soda lye of 55—65° Tw. is generally employed. A caustic solution of 15° Tw. does not mercerise, a slight effect, however, can be seen when soda lye of 25° Tw. is used. The mercerising effect increases with the strength of the alkaline liquid, the maximum being obtained with lye of 65° Tw.

The temperature of the lye has also great bearing upon the mercerising: as a rule, the lower the temperature, the better are the results. With dilute liquids the influence of the temperature is more marked than with concentrated lyes; e. g. a. soda lye of 65° Tw. gives equal results at 32 and at 175° F., whilst a lye of 25—35° Tw. only yields a mercerising effect when worked cold. The length of time the cloth is submitted to the action of the alkali is of little importance as to the result.

Paul Gardner tabulated the results as to the shrinking of makko yarn, treated at various temperatures and with soda lye of varying strength. In the following table the shrinking of the fibre is expressed in percentage, as compared to the original length:

Soda Lye	7½° Tw			15° Tw			23½° Tw			42° Tw			53° Tw			64° Tw		
Minutes	1	10	30	1	10	30	1	10	30	1	10	30	1	10	30	1	10	30
Temperature																		
2° C.	0	0	0	1	1	1	12,2	15,2	15,8	19,2	19,8	21,5	22,7	22,7	22,7	24,2	24,5	24,7
18° C.	0	0	0	0	0	0	8	8,8	11,8	19,8	20,1	21,2	22.2	22,3	22,3	23,5	23,8	24,7
30° C.	0	0	0	0	0	0	4,6	4,6	6	19	19,5	19	18,5	19,5	19,8	20,7	21	21,1
80° C.	0	0	0	0	0	0	3,5	3,5	9,8	13,4	13,7	14,2	15	15	15,5	15	15,2	15,4

The property of the lye to impart to the goods a greater strength, is utilized in dyeing thin materials, which are treated and manipulated with difficulty — by mercerising them with a lye of 15—20°; at the same time the fibre attains greater affinity for the dyestuffs.

Two methods can be adopted in mercerising both pieces and yarns: either the cotton is subjected unstretched to the action of the concentrated lye which is kept cold, and is afterwards stretched; or it is stretched and mercerised simultaneously. For both methods a number of machines have been introduced into practice, upon which, however, it is needless to dilate at this juncture.

When mercerising goods, these pass through concentrated and well-cooled soda lye in a padding machine where they are squeezed by heavy cast-iron rollers; they are then wound up, allowed to lie for some time, and stretched on the frame, or sometimes are run on to the stentering machine directly after passing the rollers of the padding machine. Whilst being stentered the material is rinsed with hot water and then soured and washed in a cistern. The wash water is repeatedly used until it twaddles 6—8°, and is then used for other purposes e. g. for bleaching.

A large number of mercerising machines have been constructed; fig. 9 illustrates a mercerising plant of Sir James Farmer & Sons Ltd., Manchester.

Raw material is very seldom mercerised, as the sizing prevents it from being evenly impregnated with the lye, therefore steeped and boiled goods are generally used and the chemicking operation is carried out after mercerising.

Sometimes the mercerisation of multicoloured fabrics is a final operation by which in certain cases a saving of labour is effected. The following patterns of which No. 1 is not mercerised, No. 2 is mercerised, show the effect of subsequent mercerisation.

The yarns were dyed with Thiogene Rubine O and topped with Thiogene Cyanine G.

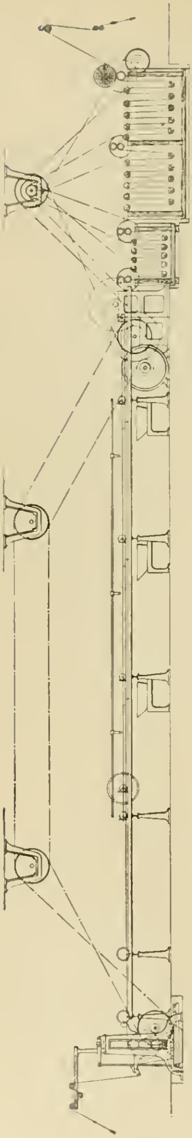
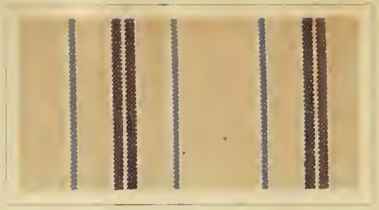
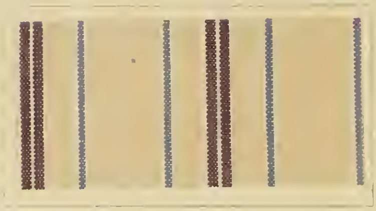


Fig. 9.
Mercerising machine (Mather & Platt Ltd., Manchester).



Pattern 1.



Pattern 2.

It is, of course, essential that only such dyestuffs may be chosen for the production of this article which resist the action of strong soda lye and subsequent souring.

It goes without saying that for the production of this article only such dyestuffs may be employed which resist the action of strong caustic soda and the subsequent acidifying process. The following table shows the degree of bleeding — indicated by the figures — on jointly mercerised white, when being worked with a lye of 32° Tw.

1 does not bleed,
2 bleeds slightly,
3 bleeds perceptibly,
4 bleeds considerably.

	Alteration	Bleeding
Dianil Yellow 3G	fuller, trace greenish	1
Dianil Pure Yellow HS	" " "	1-2
Oxydianil Yellow G	fuller	1-2
Oxydianil Yellow O	"	1-2
Cresotine Yellow G	"	2
Dianil Yellow G	"	2
Aurophenine O	"	2
Dianil Yellow R	"	2
Dianil Yellow 2R	"	2
Dianil Direct Yellow S	"	1-2
Dianil Orange G	fuller, trace more yellow	1-2
Dianil Orange N	fuller, trace more red	1-2
Dianil Orange F	" " " "	1-2
Dianil Orange R	" " " "	1-2
Tolulyene Orange R	" " " "	1-2
Dianil Brown 3GO	" " " "	1-2
Dianil Brown 5G	" " " "	1-2
Dianil Copper Brown O	fuller	2
Dianil Brown 2G	fuller, trace more red	2
Dianil Japonine G	" " " "	2
Dianil Brown 3R	" " " "	2
Dianil Brown R	fuller, trace more yellow	2
Dianil Brown MH	fuller	2
Dianil Brown MH (diazotised and developed)	"	1
Dianil Brown X	"	2
Dianil Brown G	"	2
Dianil Brown M	"	2
Dianil Fast Brown R	"	1-2
Dianil Fast Brown B	"	1-2
Dianil Brown BR	"	2
Dianil Brown BD	"	2
Dianil Brown B	"	2
Dianil Brown D	"	2
Dianil Red 4B	"	3
Brilliant Dianil Red R	"	3
Dianil Red R	"	3
Delta Purpurine 5B	"	3
Dianil Fast Scarlet 4BS	fuller	3-4
Dianil Scarlet 2R	"	4
Dianil Pink BD	"	2-3
Dianil Scarlet G	"	4
Dianil Fast Scarlet	"	3
8BS	"	3
Dianil Red 10B	"	3
Dianil Fast Red PH	"	3
Dianil Crimson G	"	3
Dianil " B	"	3
Dianil Claret Red G	"	3
Dianil Claret Red B	"	3
Dianil Violet H	"	3
Dianil Blue H6G	"	2-3
Dianil Blue H3G	"	3-4
Dianil Blue G	"	3
Dianil Blue B	"	3
Dianil Blue H2G	"	3
Dianil Azurine G	"	2
Dianil Blue R	"	3
Dianil Blue 2R	"	3
Dianil Blue BX	"	3
Dianil Blue HG	"	3
Dianil Indigo O	"	3
Dianil Darkblue R	fuller, more red	3
Dianil Darkblue 3R	fuller	3
Dianil Blue 3R	fuller, trace more green	3
Dianil Blue 4R	" " " "	3
Dianil Green B	fuller, trace more yellow	1-2
Dianil Green G	" " " "	2
Dianil Darkgreen B	" " " "	2
Dianil Black ES	fuller	4
Dianil Black ES (Beta Naphthol)	"	2
Dianil Black G	"	4
Dianil Black CR	"	4
Dianil Black CR (Beta Naphthol)	"	3

	Alteration	Bleeding
Dianil Black R .	fuller	4
Dianil Black CB . .	„	4
Dianil Black PG . .	„	4
Patent Dianil Black FF conc. . . .	„	2
Patent Dianil Black FFC conc. . . .	„	2
Patent Dianil Black FFT conc.. . .	„	2
Patent Dianil Black FFA extra conc..	„	2-3
Patent Dianil Black RW extra . . .	„	2-3
Patent Dianil Black EB conc. . . .	„	2-3
Patent Dianil Black FB	„	2
Thiogene Golden Yellow AO . .	fuller, trace more red	1
Thiogene Yellow GG	„ „ „ „	1
Thiogene Yellow G.	„ „ „ „	1
Thiogene Orange OG	„ „ „ „	1
Thiogene Orange RG	„ „ „ „	1
Thiogene Orange R	„ „ „ „	1
Thiogene Orange RR	fuller, trace more yellow	1
Thiogene Brown GC	„ „ „ „	1
Thiogene Khaki O .	fuller	1
Thiogene Brown GR	fuller, trace more yellow	1
Thiogene Brown GRR	„ „ „ „	1
Thiogene Brown R .	„ „ „ „	1
Thiogene Brown RR	„ „ „ „	1
Thiogene Brown S .	„ „ „ „	1
Thiogene Catechu R	„ „ „ „	1
Thiogene Darkred G	„ „ „ „	1
Thiogene Darkred R	„ „ „ „	1
Thiogene Rubine O	„ „ „ „	1
Thiogene Rubine O coppered . . .	fuller	1
Thiogene Heliotrope O	fuller	1
Thiogene Violet B .	fuller, more red	1
Thiogene Violet V .	„ „ „	1
Thiogene Cyanine G	„ „ „	1
Thiogene Cyanine O	„ „ „	1
Thiogene Blue B .	„ „ „	1
Thiogene Blue R .	„ „ „	1
Thiogene Blue RR .	„ „ „	1
Thiogene Darkblue BTL	„ „ „	1
Melanogene Blue B.	„ „ „	1
Thiogene Green B .	fuller	1
Thiogene Green GG	„	1
Thiogene Green BL extra	„	1
Thiogene Green GL extra	„	1
Thiogene Black M conc.	fuller, more blue	1
Thiogene Black BB conc.	„ „ „	1
Thiogene Black BRR conc.	„ „ „	1
Thiogene Black M liquid	„ „ „	1
Thiogene Black BRR liquid	„ „ „	1
Thiogene Black 4B conc.	„ „ „	1
Thiogene Diamond Black V	fuller	1
Para Red	more blue	2
Turkey Red . . .	„	1
Indigo MLB . . .	purer, more blue	1
Indigo MLB/T . .	fuller, more red	1
Aniline Black . . .	fuller, more brown	1
Diphenyl Black . .	„ „ „	1

The colours of basic dyestuffs are destroyed by lye treatment.

* * *

In order to distinguish mercerised from unmercerised fabrics, either a microscopical test or a comparative trial dye with Methylene Blue etc. is made. The latter dyes the mercerised fibre considerably darker than the non-mercerised fibre. A convenient test, recommended by H. Lange, is the following.

The previously wetted cotton is treated for three minutes in a solution obtained in the following manner: 5 parts potassium iodine are dissolved in 12—24 parts water, 1—2 parts iodine are added, and mixed with 30 parts chloride of zinc dissolved in 12 parts water. When washed out with water, non-mercerised cotton is very quickly discoloured, whereas mercerised retains the blue colour longer.

◆

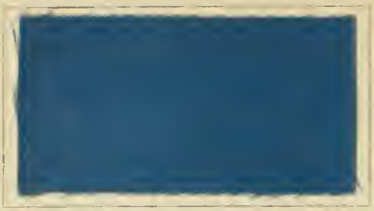
The silk lustre produced by mercerising goods in the stretched state, can be materially enhanced by mechanical aids, as the fibre has become to a certain degree plastic by mercerisation. This is done by impression of fine grooves which reflect the light in a peculiar manner, by means of the, so-called Silk-Finish-calander.

The calander contains a steel cylinder and a paper cylinder which can be put under hydraulic pressure of about 200—250 atmospheres. The steel cylinder can be heated from within with gas, and is very finely engraved (10—20 lines per millimetre). It is necessary to state that goods whose fibres have already been previously weakened by printing, dyeing, or steaming, are still further weakened, sometimes even cut, by calandering, and that certain faults and unevennesses in the cloth are becoming more apparent by this operation. The silk lustre produced in this manner is more beautiful and more lasting on mercerised than on non-mercerised goods.

In order to obtain a durable silk finish, the goods are sprinkled (according to the British Patent Nr. 17242 (1904) by P. Krais and the Bradford Dyers' Association) before and after calandering with a solution of nitrocellulose in amylformiate, which produces an extremely fine film on the fabric.

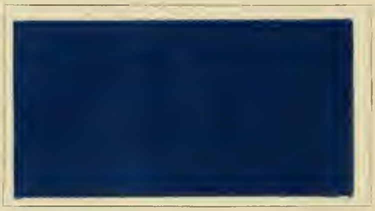
The effects obtained by mercerising, calandering and embossing may be seen on the following patterns:

They were dyed together in a bath with Dianil Blue H6G. No. 1 is dyed on bleached satin, No. 2 and No. 3 on bleached and mercerised satin, and finished on the well-known Schreiner Silk Finish calander.



No. 1. Dianil Blue H6G
on bleached Satin.

No. 2. Dianil Blue H6G
on bleached and mercerised Satin.



No. 3. Dianil Blue H6G, dyed same as No. 2,
and finished on the silk finish calander.

The impression of fine grooves is occupying an ever growing field in the embellishing industry of cotton fabrics. The following specimens were executed on machines and engravings by Joh. Kleinewefers Söhne of Crefeld.

Pattern 1.

1 %	Aurophenine O
0,05 %	Dianil Brown MH
1 %	soda
15 %	common salt.

Pattern 2.

1,5 %	Aurophenine O
0,6 %	Dianil Blue H6G
25 %	common salt.

Pattern 3.

0,4 %	Dianil Brown MH
0,2 %	Toluylene Orange R
0,05 %	Dianil Fast Red PH
1 %	soda
10 %	common salt.

Pattern 4.

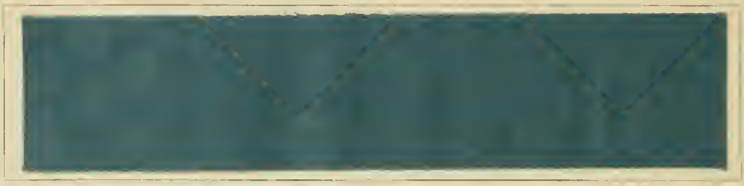
0,25 %	Dianil Blue H6G
0,25 %	Dianil Green G
5 %	common salt.

Pattern 5.

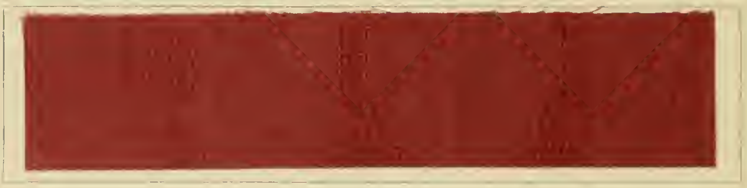
4 %	Dianil Fast Scarlet 8BS
0,6 %	Aurophenine O
2 %	soda
30 %	common salt.

MODERN EMBOSSING EFFECTS ON MERCERISED SATIN.

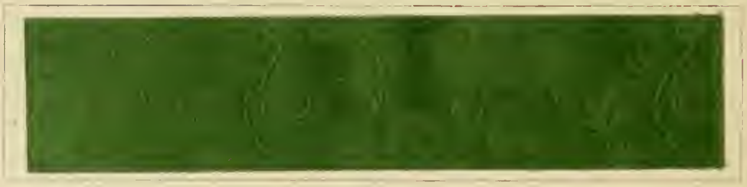
Pattern 1.



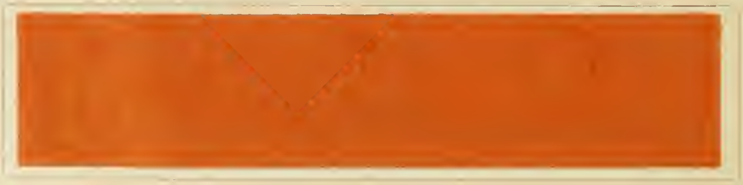
Pattern 2.



Pattern 3.



Pattern 4.



Pattern 5.

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1. TABLE OF SOME ATOMIC WEIGHTS.

O = 16.

Aluminium	Al	27,1	Magnesium	Mg	24,36
Antimony	Sb	120	Manganese	Mn	55
Arsenic	As	75	Mercury	Hg	203
Barium	Ba	137,4	Molybdenum	Mo	96
Bismuth	Bi	208,5	Nickel	Ni	58,7
Boron	B	11	Nitrogen	N	14,04
Bromine	Br	79,96	Oxygen	O	16
Cadmium	Cd	112,4	Phosphorus	P	31
Calcium	Ca	40	Platinum	Pt	194,8
Carbon	C	12	Potassium	K	39,15
Cerium	Ce	140	Silicium	Si	28,4
Chlorine	Cl	35,5	Silver	Ag	107,93
Chromium	Cr	52,1	Sodium	Na	23,05
Cobalt	Co	59	Strontium	Sr	87,6
Copper	Cu	63,6	Sulphur	S	32,06
Fluorine	F	19	Tin	Sn	118,5
Gold	Au	197,2	Titanium	Ti	48
Hydrogen	H	1,01	Tungsten	W	184
Iodine	J	126,85	Uranium	U	239,5
Iron	Fe	56	Vanadium	V	51,2
Lead	Pb	206,9	Zinc	Zn	65,4

2. TABLE OF MOLECULAR WEIGHTS

of chemicals used in dyeing.

Name	Formula	Mol. Weight
Acetate of Alumina	$Al_2 (C_2H_3O_2)_6$	408
Acetate of Ammonia	$NH_4C_2H_3O_2$	77
Acetate of Chrome (basic)	$Cr_2 (C_2H_3 O_2)_4 (OH)_2$	374
Acetate of Chrome (normal)	$Cr_2 (C_2H_3O_2)_6$	458
Acetate of Lime	$Ca (C_2H_3O_2)_2$	158
Acetate of Nickel	$(C_2H_3O_2)_2 Ni$	177
Acetate of Soda	$Na C_2 H_3 O_2+3H_2O$	136
Acetate of Tin	$Sn (C_2H_3O_2)_2$	237
Acetic Acid	$CH_3 COOH$	60
Acetine	$C_3H_5(C_2H_3O_2)_3$	218
Acid Sodium Sulphate	$NaHSO_4$	120,12
Acid Sodium Sulphite	$NaHSO_3$	104
Alcohol	$C_2 H_5 OH$	46
Alpha-Naphthylamine	$C_{10}H_7NH_2$	143
Alum (Potash-)	$Al_2(SO_4)_3K_2SO_4+24H_2O$	949
Aluminium Chloride	$Al_2 Cl_6$	267
Aluminium Sulpho-Acetate	$Al_2 SO_4 (C_2H_3O_2)_4$	386
Ammonia	NH_3	17
Ammonium Chloride	NH_4Cl	54
Ammonium-Tin Chloride	$SnCl_4+2NH_4Cl$	367
Ammonium Vanadate	$(NH_4)_3 VO_4$	169
Aniline	$C_6H_5NH_2$	93
Aniline Salt	$C_6H_5NH_2HCl$	130
Antimony Fluoride	$Sb Fl_3$	177
Antimony Oxide	$Sb_2 O_3$	288
Antimony Salt	$Sb Fl_3 (NH_4)_2 SO_4$	309
Antimony-Sodium Fluoride	$SbFl_3 NaFl$	219
Barium Chloride	$BaCl_2+2H_2O$	244
Benzene	$C_6 H_6$	78
Beta Naphthol	$C_{10} H_7 OH$	144
Bichromate of Soda	$Na_2Cr_2O_7+2H_2O$	298
Bichromate of Potash	$K_2Cr_2O_7$	295
Bisulphite of Chrome	$Cr_2 (HSO_3)_6$	591
Borax	$Na_2 B_4 O_7+10H_2O$	382
Calcium Chloride	$CaCl_2$	111
Caustic Lime	CaO	56
Caustic Soda	$NaOH$	40
Caustic Potash	KOH	56
Cerochloride	$Ce Cl_3$	246
Chalk	$Ca CO_3$	100
Chlorate of Alumina	$Al_2 (ClO_3)_6$	555
Chloride of Chrome (basic)	$Cr_2 Cl_2(OH)_4$	243
Chlorate of Potassium	$K ClO_3$	123
Chlorate of Sodium	$Na ClO_3$	107
Chromate of Chrome	$Cr_2 (CrO_4)_3$	453
Chromate of Lead	$PbCrO_4$	323
Chrome Alum	$Cr_2(SO_4)_3K_2SO_4+24H_2O$	999
Chrome Oxide	Cr_2O_4	152
Chromium Nitro-Acetate	$Cr_2(NO_3)_3(C_2H_3O_2)_3$	467
Common Salt	$Na Cl$	59
Cupric Chloride	$Cu Cl_2+2H_2O$	171
Double Chloride of Tin	$Sn Cl_4+3H_2O$	314
Ferric Acetate	$Fe_2 (C_2H_3O_2)_6$	466
Ferric Chloride	$Fe_2 Cl_6$	325
Ferrous Acetate	$Fe (C_2H_3 O_2)_2$	174
Ferrous Chloride	$Fe Cl_2$	127
Ferrous Sulphate	$FeSO_4+7H_2O$	278
Fluoride of Chrome	$Cr_2 Fl_6+8H_2O$	362
Glauber's Salt	$Na_2SO_4+10H_2O$	322
Glycerine	$C_3 H_5 (OH)_3$	92
Hydrate of Alumina	$Al_2O_6H_6$	541
Hydrochloric Acid	HCl	36
Hydrofluoric Acid	HFl	20
Hyposulphite of Soda	$Na_2S_2O_3+5H_2O$	248
Lactic Acid	$C_3H_6O_3$	90
Magnesium Chloride	$Mg Cl_2+6H_2O$	203
Manganous Chloride	$Mn Cl_2+4H_2O$	198
Nitrate of Chrome	$Cr_2(NO_3)_6$	476
Nitrate of Lead	$Pb(NO_3)_2$	331
Nitric Acid	HNO_3	63
Oxalate of Ammonia	$(NH_4)_2 C_2 O_4 + H_2O$	142
Oxalate of Antimony	$Sb (C_2O_4K)_3+6H_2O$	610
Oxalic Acid	$C_2 O_4 H_2+2H_2O$	126
Oxide of Lead	$Pb O$	223

Name	Formula	Mol. Weight
Paranitraniline	$C_6H_4<^{NO_2\,(1)}_{NH_2\,(4)}$	138
Permanganate of Potassium	$KMnO_4$	158
Peroxide of Hydrogen	H_2O_2	34
Phenol	C_6H_5OH	94
Phosphate of Soda	$Na_2HPO_4+12H_2O$	358
Potash	$K_2CO_3+2H_2O$	174
Potassium Oxalate	$KH(COO)_2$	128
Red Prussiate	$K_6Fe_2(CN)_{12}$	659
Resorcine	$C_6H_4(OH)_2$	110
Silicate of Soda	$Na_2Si_4O_9$	304
Sugar of Lead	$Pb(C_2H_3O_2)_2+3H_2O$	379
Sulphate of Alumina	$Al_2(SO_4)_3+18H_2O$	667
Sulphate of Cadmium	$CdSO_4+2,6H_2O$	256
Sulphate of Copper	$CuSO_4+5H_2O$	250
Sulphate of Lead	$PbSO_4$	302
Sulphate of Magnesia	$MgSO_4+7H_2O$	247
Sulphate of Nickel	$NiSO_4+7H_2O$	281
Sulphate of Zinc	$ZnSO_4+7H_2O$	288
Sulphocyanide of Ammonia	NH_4SCN	76
Sulphocyanide of Copper	$Cu(SCN)_2$	180
Sulphocyanide of Iron	$Fe(SCN)_2$	172
Sulphocyanide of Potassium	$K(SCN)$	97
Sulphuric Acid	H_2SO_4	98
Sulphurous Acid	SO_2	64
Soda calc.	Na_2CO_3	106
Soda cryst.	$Na_2CO_3+10H_2O$	286
Sodium Aluminate	$Al_2O_6Na_6$	289
Sodium Bisulphite	$NaHSO_3$	104
Sodium Hydrosulphite cryst.	$Na_2S_2O_4+2H_2O$	194
Sodium Nitrite	$NaNO_2$	69
Sodium Peroxide	Na_2O_2	78
Sodium Sulphide	Na_2S+9H_2O	240
Stannate of Soda	Na_2SnO_3	213
Stannic Hydrate	$SnO(OH)_2$	169
Stannous Hydrate	$Sn(OH)_2$	153
Tannin	$C_{14}H_{10}O_9$	322
Tartar	$C_4O_6KH_5$	188
Tartar Emetic	$K(SbO)C_4O_6H_4+{}^1/_2H_2O$	332
Tartar Substitute	$NaHSO_4$	120
Tartaric Acid	$C_2H_2(OH)_2(COOH)_2$	150
Thiosulphate	$Na_2S_2O_3+5H_2O$	248
Tin Chloride	$SnCl_4$	260
Tin Salt	$SnCl_2+2H_2O$	225
Tungstate of Soda	$Na_2WO_4+2H_2O$	330
Water	H_2O	18
Yellow Prussiate	$K_4Fe(CN)_6+3H_2O$	423
Zinc Chloride	$ZnCl_2$	136

3. COMPARISON OF THERMOMETRIC SCALES.

Celsius	Réaumur	Fahrenheit	Celsius	Réaumur	Fahrenheit	Celsius	Réaumur	Fahrenheit
+ 100	+ 80	+ 212	+ 53	+ 42,4	+ 127,4	+ 6	+ 4,8	+ 42,8
99	79,2	210,2	52	41,6	125,6	5	4	42
98	78,4	208,4	51	40,8	123,8	4	3,2	39,2
97	77,6	206,6	50	40	122	3	2,4	37,4
96	76,8	204,8	49	39,2	120,2	2	1,6	35,6
95	76	203	48	38,4	118,4	1	0,8	33,8
94	75,2	201,2	47	37,6	116,6	0	0	32
93	74,4	199,4	46	36,8	114,8	— 1	— 0,8	30,2
92	73,6	197,6	45	36	113	2	1,6	28,4
91	72,8	195,8	44	35,2	111,2	3	2,4	26,6
90	72	194	43	34,4	109,4	4	3,2	24,8
89	71,2	192,2	42	33,6	107,6	5	4	23
88	70,4	190,4	41	32,8	105,8	6	4,8	21,2
87	69,6	188,6	40	32	104	7	5,6	19,4
86	68,8	186,8	39	31,2	102,2	8	6,4	17,6
85	68	185	38	30,4	100,4	9	7,2	15,8
84	67,2	183,2	37	29,6	98,6	10	8	14
83	66,4	181,4	36	28,8	96,8	11	8,8	12,2
82	65,6	179,6	35	28	95	12	9,6	10,4
81	64,8	177,8	34	27,2	93,2	13	10,4	8,6
80	64	176	33	26,4	91,4	14	11,2	6,8
79	63,2	174,2	32	25,6	89,6	15	12	5
78	62,4	172,4	31	24,8	87,8	16	12,8	3,2
77	61,6	170,6	30	24	86	17	13,6	1,4
76	60,8	168,8	29	23,2	84,2	18	14,4	— 0,4
75	60	167	28	22,4	82,4	19	15,2	2,2
74	59,2	165,2	27	21,6	80,6	20	16	4
73	58,4	163,4	26	20,8	78,8	21	16,8	5,8
72	57,6	161,6	25	20	77	22	17,6	7,6
71	56,8	159,8	24	19,2	75,2	23	18,4	9,4
70	56	158	23	18,4	73,4	24	19,2	11,2
69	55,2	156,2	22	17,6	71,6	25	20	13
68	54,4	154,4	21	16,8	69,8	26	20,8	14,8
67	53,6	152,6	20	16	68	27	21,6	16,6
66	52,8	150,8	19	15,2	66,2	28	22,4	18,4
65	52	149	18	14,4	64,4	29	23,2	20,2
64	51,2	147,2	17	13,6	62,6	30	24	22
63	50,4	145,4	16	12,8	60,8	31	24,8	23,8
62	49,6	143,6	15	12	59	32	25,6	25,6
61	48,8	141,8	14	11,2	57,2	33	26,4	27,4
60	48	140	13	10,4	55,4	34	27,2	29,2
59	47,2	138,2	12	9,6	53,6	35	28	31
58	46,4	136,4	11	8,8	51,8	36	28,8	32,8
57	45,6	134,6	10	8	50	37	29,6	34,6
56	44,8	132,8	9	7,2	48,2	38	30,4	36,4
55	44	131	8	6,4	46,4	39	31,2	38,2
54	43,2	129,2	7	5,6	44,6	40	32	40

For conversion of:
°C into °R multiply by 4, divide by 5,
°C into °F „ „ 9, „ „ 5, add 32,
°R into °C „ „ 5, „ „ 4,
°R into °F „ „ 9, „ „ 4, add 32,
°F into °R subtract 32, multiply by 4, divide by 9,
°F into °C „ 32, „ „ 5, „ „ 9.

4. COMPARISON OF SPECIFIC GRAVITIES IN DEGREES BEAUMÉ AND TWADDLE.

Spec. Grav. (at 59° F)	Degrees Beaumé	Degrees Twaddle	Spec Grav. (at 59° F	Degrees Beaumé	Degrees Twaddle	Spec. Grav. (at 59° F)	Degrees Beaumé	Degrees Twaddle
1,000	0	0	1,290	32,4	58	1,580	53,0	116
1,005	0,7	1	1,295	32,8	59	1,585	53,3	117
1,010	1,4	2	1,300	33,3	60	1,590	53,6	118
1,015	2,1	3	1,305	33,7	61	1,595	53,9	119
1,020	2,7	4	1,310	34,2	62	1,600	54,1	120
1,025	3,4	5	1,315	34,6	63	1,605	54,4	121
1,030	4,1	6	1,320	35,0	64	1,610	54,7	122
1,035	4,7	7	1,325	35,4	65	1,615	55,0	123
1,040	5,4	8	1,330	35,8	66	1,620	55,2	124
1,045	6,0	9	1,335	36,2	67	1,625	55,5	125
1,050	6,7	10	1,340	36,6	68	1,630	55,8	126
1,055	7,4	11	1,345	37,0	69	1,635	56,0	127
1,060	8,0	12	1,350	37,4	70	1,640	56,3	128
1,065	8,7	13	1,355	37,8	71	1,645	56,6	129
1,070	9,4	14	1,360	38,2	72	1,650	56,9	130
1,075	10,0	15	1,365	38,6	73	1,655	57,1	131
1,080	10,6	16	1,370	39,0	74	1,660	57,4	132
1,085	11,2	17	1,375	39,4	75	1,665	57,7	133
1,090	11,9	18	1,380	39,8	76	1,670	57,9	134
1,095	12,4	19	1,385	40,1	77	1,675	58,2	135
1,100	13,0	20	1,390	40,5	78	1,680	58,4	136
1,105	13,6	21	1,395	40,8	79	1,685	58,7	137
1,110	14,2	22	1,400	41,2	80	1,690	58,9	138
1,115	14,9	23	1,405	41,6	81	1,695	59,2	139
1,120	15,4	24	1,410	42,0	82	1,700	59,5	140
1,125	16,0	25	1,415	42,3	83	1,705	59,7	141
1,130	16,5	26	1,420	42,7	84	1,710	60,0	142
1,135	17,1	27	1,425	43,1	85	1,715	60,2	143
1,140	17,7	28	1,430	43,4	86	1,720	60,4	144
1,145	18,3	29	1,435	43,8	87	1,725	60,6	145
1,150	18,8	30	1,440	44,1	88	1,730	60,9	146
1,155	19,3	31	1,445	44,4	89	1,735	61,1	147
1,160	19,8	32	1,450	44,8	90	1,740	61,4	148
1,165	20,3	33	1,455	45,1	91	1,745	61,6	149
1,170	20,9	34	1,460	45,4	92	1,750	61,8	150
1,175	21,4	35	1,465	45,8	93	1,755	62,1	151
1,180	22,0	36	1,470	46,1	94	1,760	62,3	152
1,185	22,5	37	1,475	46,4	95	1,765	62,5	153
1,190	23,0	38	1,480	46,8	96	1,770	62,8	154
1,195	23,5	39	1,485	47,1	97	1,775	63,0	155
1,200	24,0	40	1,490	47,4	98	1,780	63,2	156
1,205	24,5	41	1,495	47,8	99	1,785	63,5	157
1,210	25,0	42	1,500	48,1	100	1,790	63,7	158
1,215	25,5	43	1,505	48,4	101	1,795	64,0	159
1,220	26,0	44	1,510	48,7	102	1,800	64,2	160
1,225	26,4	45	1,515	49,0	103	1,805	64,4	161
1,230	26,9	46	1,520	49,4	104	1,810	64,6	162
1,235	27,4	47	1,525	49,7	105	1,815	64,8	163
1,240	27,9	48	1,530	50,0	106	1,820	65,0	164
1,245	28,4	49	1,535	50,3	107	1,825	65,2	165
1,250	28,8	50	1,540	50,6	108	1,830	65,5	166
1,255	29,3	51	1,545	50,9	109	1,835	65,7	167
1,260	29,7	52	1,550	51,2	110	1,840	65,9	168
1,265	30,2	53	1,555	51,5	111	1,845	66,1	169
1,270	30,6	54	1,560	51,8	112	1,850	66,3	170
1,275	31,1	55	1,565	52,1	113	1,855	66,5	171
1,280	31,5	56	1,570	52,4	114	1,860	66,7	172
1,285	32,0	57	1,575	52,7	115	1,865	67,0	173

5. COMPARISON OF DEGREES BEAUMÉ AND SPECIFIC GRAVITIES OF LIQUIDS HEAVIER THAN WATER.

Degrees Bé	Spec. Grav. 12,5° C	Degrees Bé	Spec. Grav. 12,5° C	Degrees Bé	Spec. Grav. 12,5° C	Degrees Bé	Spec. Grav. 12,5° C	Degrees Bé	Spec. Grav. 12,5° C	Degrees Bé	Spec. Grav. 12,5° C.
0	1,0000	13	1,0990	26	1,2198	39	1,3703	52	1,5633	65	1,8195
1	1,0069	14	1,1074	27	1,2301	40	1,3834	53	1,5804	66	1,8428
2	1,0140	15	1,1160	28	1,2407	41	1,3968	54	1,5978	67	1,839
3	1,0212	16	1,1247	29	1,2515	42	1,4105	55	1,6158	68	1,864
4	1,0285	17	1,1335	30	1,2624	43	1,4244	56	1,6342	69	1,885
5	1,0358	18	1,1425	31	1,2736	44	1,4386	57	1,6529	70	1,909
6	1,0434	19	1,1516	32	1,2849	45	1,4531	58	1,6720	71	1,935
7	1,0509	20	1,1608	33	1,2965	46	1,4678	59	1,6916	72	1,960
8	1,0587	21	1,1702	34	1,3082	47	1,4828	60	1,7116		
9	1,0665	22	1,1798	35	1,3202	48	1,4984	61	1,7322		
10	1,0745	23	1,1896	36	1,3324	49	1,5141	62	1,7532		
11	1,0825	24	1,1994	37	1,3447	50	1,5301	63	1,7748		
12	1,0907	25	1,2095	38	1,3574	51	1,5466	64	1,7960		

* * *

6. COMPARISON OF DEGREES BEAUMÉ AND SPECIFIC GRAVITIES OF LIQUIDS LIGHTER THAN WATER.

Degrees Bé	Spec. Grav. 12,5° C	Degrees Bé	Spec. Grav. 12,5° C	Degrees Bé	Spec. Grav. 12,5° C	Degrees Bé	Spec. Grav. 12,5° C	Degrees Bé	Spec. Grav. 12,5° C	Degrees Bé	Spec. Grav. 12,5° C
10	1,0000	19	0,9420	28	0,8902	37	0,8439	46	0,8022	55	0,7644
11	0,9932	20	0,9359	29	0,8848	38	0,8391	47	0,7978	56	0,7604
12	0,9865	21	0,9300	30	0,8795	39	0,8343	48	0,7935	57	0,7565
13	0,9799	22	0,9241	31	0,8742	40	0,8295	49	0,7892	58	0,7526
14	0,9733	23	0,9183	32	0,8690	41	0,8249	50	0,7849	59	0,7487
15	0,9669	24	0,9125	33	0,8639	42	0,8202	51	0,7807	60	0,7449
16	0,9605	25	0,9068	34	0,8588	43	0,8156	52	0,7766	61	0,7411
17	0,9542	26	0,9012	35	0,8538	44	0,8111	53	0,7725		
18	0,9480	27	0,8957	36	0,8488	45	0,8066	54	0,7684		

* * *

7. TABLE OF THE TENSION OF STEAM AT TEMPERATURES FROM 104° F (40° C) UPWARDS.

Temperature	Tension in Mm	in Atmospheres	Pressure on 1 □cm in Kos	Temperature	Tension in Mm	in Atmospheres	Pressure on 1 □cm in Kos
+ 40°	54·906	0·072	0·07465	+ 105°	906·41	1·193	1·23236
45	71·391	0·094	0·09706	110	1075·37	1·415	1·46210
50	91·982	0·121	0·12505	115	1269·41	1·673	1·72592
55	117·478	0·154	0·15972	120	1491·28	1.962	2·02755
60	148·791	0·196	0·20323	125	1743·88	2·294	2·37098
65	186·945	0·246	0·25417	130	2030·28	2·671	2·76037
70	233·093	0·306	0·31692	135	2353·73	3·097	3·20013
75	288·517	0·380	0.39227	140	2717·63	3·575	3·69400
80	354·643	0·466	0·48217	145	3125·55	4·112	4·24050
85	433·041	0·570	0·58877	150	3581·23	4·712	4·86904
90	525·450	0·691	0·71440	155	4088·56	5·380	5·55881
95	633·778	0·834	0·86168	160	4651·62	6·120	6·32434
100	760·00	1·000	1·03330				

8. MEASURES AND WEIGHTS.

1 Metre = 10 Decimetres = 100 Centimetres = 1000 Millimetres.
1 Yard = 0,9144 Metres.
1 Inch = 2,540 Centimetres.
1 Cubic Metre = 1000 Litres.
1 Litre = 1000 Cubic Centimetres.
1 Gallon = 4 Quarts = 8 Pints = 16 Gills = 4,5436 Litres.
1 Kilogramm = 1000 Grammes.
1 Pound (lb) = 16 Ounces (oz.) = 453,6 Grammes.
1 Kilogramm = 2,205 lbs.

* * *

NOTE. The specific gravities of solutions given in the following tables refer mostly to water of 59^0 F. In order to compare them to water of greatest density (+ 40^0 F), it is necessary to multiply them by 0,99916.

9. SODIUM-COMPOUNDS.

Sodium Hydroxide or **Caustic Soda,** NaOH, molecular weight 40, is a white, crystalline, brittle substance, easily soluble in water: 1 part of solid caustic soda dissolves in 2 parts of cold, and in $^1/_2$ part of warm water. Caustic soda is put upon the market in lumps or in the form of leaves, also as an aqueous solution under the name of soda-lye. Its use in the form of leaves is preferable on account of its dissolving more quickly. The quantity of caustic soda in soda-lye is determined either by degrees of Tw. or titrometrically. Soda-lye is used in bleaching and mercerizing, for neutralizing, and for the production of alkaline aluminium and chrome mordants, and for many other purposes. Caustic soda must, for most purposes, be free from iron. 1 gramm mol. NaOH is contained in 90,7 cc resp. 123,1 gr. soda-lye 71$^1/_2{}^0$ Tw. or in 212 cc. resp. 250,2 grs soda-lye 36^0 Tw.

Specific Gravity of Caustic Soda at 59^0 F.

(Lunge.)

Spec. Grav.	Bé	Twaddle	% NaOH	Spec. Grav.	Bé	Twaddle	% NaOH	Spec. Grav.	Bé	Twaddle	% NaOH
1,007	1	1,4	0,61	1,142	18	28,4	12,64	1,320	35	64,0	28,83
1,014	2	2,8	1,20	1,152	19	30,4	13,55	1,332	36	66,4	29,93
1,022	3	4,4	2,00	1,162	20	32,4	14,37	1,345	37	69,0	31,22
1,029	4	5,8	2,71	1,171	21	34,2	15,13	1,357	38	71,4	32,47
1,036	5	7,2	3,35	1,180	22	36,0	15,91	1,370	39	74,0	33,69
1,045	6	9,0	4,00	1,190	23	38,0	16,77	1,383	40	76,6	34,96
1,052	7	10,4	4,64	1,200	24	40,0	17,67	1,397	41	79,4	36,25
1,060	8	12,0	5,29	1,210	25	42,0	18,58	1,410	42	82,0	37,47
1,067	9	13,4	5,87	1,220	26	44,0	19,58	1,424	43	84,8	38,80
1,075	10	15,0	6,55	1,231	27	46,2	20,59	1,438	44	87,6	39,99
1,083	11	16,6	7,31	1,241	28	48,2	21,42	1,453	45	90,6	41,41
1,091	12	18,2	8,00	1,252	29	50,4	22,64	1,468	46	93,6	42,83
1,100	13	20,0	8,68	1,263	30	52,6	23,67	1,483	47	96,6	44,38
1,108	14	21,6	9,42	1,274	31	54,8	24,81	1,498	48	99,6	46,15
1,116	15	23,2	10,06	1,285	32	57,0	25,80	1,514	49	102,8	47,60
1,125	16	25,0	10,97	1,297	33	59,4	26,83	1,530	50	106,0	49,02
1,134	17	26,8	11,84	1,308	34	61,6	27,80				

Sodium Peroxide Na_2O_2, molecular weight 78, is put upon the market in yellowish lumps or in powder; it must be kept well closed, as it easily absorbs moisture and carbonic acid. It dissolves in water by giving off heat, and is a very efficacious bleaching substance.

Sodium Carbonate or **Soda,** Na_2CO_3, mol. weight 106, soluble in 14 parts of cold and in about 2 parts of hot water, is commercially sold as calcined soda, Solvay soda, Na_2CO_3, or as crystal soda $Na_2CO_3 + 10H_2O$ (mol. weight 286). It is used on a large scale in bleaching and dyeing.

Specific Gravity and Proportions of Solutions of Soda at 59° F.
(Lunge.)

Spec. Grav.	Beaumé	Twaddle	Percentage by weight		1 cubic metre contains kilos	
			Na_2CO_3	Na_2CO_3 + 10 water	Na_2CO_3	Na_2CO_3 + 10 water
1,007	1	1,4	0,67	1,807	6,8	18,2
1,014	2	2,8	1,33	3,587	13,5	36,4
1,022	3	4,4	2,09	5,637	21,4	57,6
1,029	4	5,8	2,76	7,444	28,4	76,6
1,036	5	7,2	3,43	9,251	35,5	95,8
1,045	6	9,0	4,29	11,570	44,8	120,9
1,052	7	10,4	4,94	13,323	52,0	140,2
1,060	8	12,0	5,71	15,400	60,5	163,2
1,067	9	13,4	6,37	17,180	68,0	183,3
1,075	10	15,0	7,12	19,203	76,5	206,4
1,083	11	16,6	7,88	21,252	85,3	230,2
1,091	12	18,2	8,62	23,248	94,0	253,6
1,100	13	20,0	9,43	25,432	103,7	279,8
1,108	14	21,6	10,19	27,482	112,9	304,5
1,116	15	23,2	10,95	29,532	122,2	329,6
1,125	16	25,0	11,81	31,851	132,9	358,3
1,134	17	26,8	12,61	34,009	143,0	385,7
1,142	18	28,4	13,16	35,493	150,3	405,3
1,152	19	30,4	14,24	38,405	164,1	442,4

Sodium Chloride or **Common salt,** NaCl, mol. weight 58,5, soluble in $2\frac{1}{2}$ parts of water, forms regular crystals, and is used as addition in dyeing to the dye-baths of Direct and Thiogene Colours.

Specific Gravity of Solutions of Common salt at 59° F.
(Gerlach).

Spec. Grav.	Per cent NaCl	Spec. Grav.	Per cent NaCl	Spec. Grav.	Per cent NaCl
1,00725	1	1,07335	10	1,14315	19
1,01450	2	1,08097	11	1,15107	20
1,02174	3	1,08859	12	1,15931	21
1,02899	4	1,09622	13	1,16755	22
1,03624	5	1,10384	14	1,17580	23
1,04366	6	1,11146	15	1,18404	24
1,05108	7	1,11938	16	1,19228	25
1,05851	8	1,12730	17	1,20098	26
1,06593	9	1,13523	18	1,20433	26,395

Sodium Hypochlorite, NaOCl, mol. weight 74,5, is used for bleaching and can be added direct to soap solutions. It is particularly efficient in cleansing goods dyed with Ice Colours.

Sodium Hypochlorite is produced either by electrolysis of common salt by means of so-called electrolisers, or by chemical reaction of soda upon chloride of lime:

1. 100 lbs chloride of lime 36 % are carefully ground with
45 gall. water,
2. 60 lbs Solvay soda 98 % are dissolved in
22 ½ gall. boiling water, and diluted with so much water that, on being slowly entered into the chloride of lime solution, there will then be
100 gall. liquid.

The solution is stirred for ½ hour and allowed to stand overnight. This yields 65 gall. clear solution of Sodium Hypochlorite 11° Tw.

Sodium Chlorate, $NaClO_3$, mol. weight 106,5 (soluble in 1 part of cold and ⅓ part of hot water) is put upon the market in crystals, and is preferred to the corresponding Potassium salt on account of its greater solubility. It is extensively used as oxidizing medium in Aniline Black and Diphenyl Black printing, and also as Chlorate discharge.

Sodium Sulphide, $Na_2S + 9H_2O$, mol. weight 240, is put upon the market in crystals. In the melted state 50 parts correspond with 100 parts of Sodium Sulphide crystals. It is very soluble, hygroscopic, and is used as a solvent of Sulphur Colours; for the preparation of sulphide of copper etc.

Sodium Bisulphite $NaHSO_3$, mol. weight 104, forms small and easily soluble prisms, and is put upon the market as Bisulphite cryst. or in solutions of 66 ½° Tw. It is used in bleaching, for Aniline Black resists, for preparing the hydrosulphite indigo vat, and for producing certain bisulphite compounds of dyestuffs as f. i. of Alizarine Blue and Ceruleine.

Specific Gravity of Solutions of Sodium Bisulphite at 59° F.

Specific Gravity	Degrees Bé	Percentage $NaHSO_3$	Percentage SO_2	Specific Gravity	Degrees Bé	Percentage $NaHSO_3$	Percentage SO_2
1,008	1	1,6	0,4	1,171	21	16,5	10,2
1,022	3	2,1	1,3	1,190	23	18,5	11,5
1,038	5	3,6	2,2	1,210	25	20,9	12,9
1,052	7	5,1	3,1	1,230	27	23,5	14,5
1,068	9	6,5	3,9	1,252	29	25,9	15,9
1,034	11	8,0	4,8	1,275	31	28,9	17,8
1,100	13	9,5	5,7	1,298	33	31,7	19,6
1,116	15	11,2	6,8	1,321	35	34,7	22,5
1,134	17	12,8	7,8	1,345	37	38	23,6
1,152	19	14,6	9,0				

Sodium Hydrosulphite, $Na_2S_2O_4$, mol. weight 174, is obtained by the reduction of Bisulphite with zinc dust, and is principally used for setting the hydrosulphite Indigo vat.

Sodium Hydrosulphite is put upon the market in various forms:

Hydrosulphite O Hoechst is fairly stable, if kept in a cool place.

Hydrosulphite conc. powder is seven times as strong as Hydrosulphite O Hoechst, and withstands the influence of air.

Hydrosulphite NF pat. consists of a molecular mixture of Formaldehyde Hydrosulphite and Formaldehyde Bisulfite ($NaHSO_2 \cdot CH_2O + 2H_2O + NaHSO_3 \cdot CH_2O + 2H_2O$) and contains about 44% $NaHSO_2 . CH_2O + 2H_2O$. It is obtained by the reaction of Formaldehyde upon Sodium Hydrosulphite, and forms white solid bodies of fine crystalline structure. Protected from dampness and excessive heat, the substance keeps for months. In moist air it is apt to liquify; it melts on the water bath at 122° F, without losing its reducing properties. Only in its gaseous form viz. at the boil this hydrosulphite becomes efficient. Hydrosulphite NF has found extensive use: in printing with Indigo and Sulphur Colours, in discharging ice, and direct dyeing colours, also for cleansing the white in goods printed with ice colours.

Hydrosulphite NFW pat. contains zinc white in addition to Hydrosulphite NF, and is used as a discharge on raised goods. The addition of zinc white prevents the sinking into the cloth of the easily soluble discharge, and embellishes the discharged white.

Hydrosulphite NFX pat. is similar to Hydrosulphite NFW, and contains lithopone instead of zinc white. The discharges prepared with Hydrosulphite NFX have the advantage of resisting acids better than those prepared with NFW, they also produce a better white.

Hydrosulphite NF conc. is a new compound of Formaldehyde Hydrosulphite, and contains 88% $NaHSO_2 \cdot CH_2O + 2H_2O$, mol. weight 154; consequently it has twice the discharging strength of Hydrosulphite NF. The special advantage of this substance, as compared with Hydrosulphite NF, is its stability and adaptability for very concentrated white and coloured discharges.

Hydrosulphite AZ is a basic compound of zinc hydrosulphite-aldehyde, which is put upon the market as a white powder, and is used as a stripping agent in dyeing.

Sodium Sulphate, Na_2SO_4, mol. weight 142 (soluble in 20 parts water 32° F and 2½ parts boiling water), is commercially known as Glauber's Salt, $Na_2SO_4 + 10H_2O$, mol. weight 322. It is chiefly used as addition to the dyebaths of the Direct and Thiogene Colours. Glauber's salt is also put upon the market, as calcined Glauber's salt, which is free from water.

Specific Gravity of Solutions of Glauber's Salt at 66° F.

(Schiff.)

Specific Gravity	Per cent Na_2SO_4 + 10 aq.	Per cent Na_2SO_4	Specific Gravity	Per cent Na_2SO_4 + 10 aq.	Per cent Na_2SO_4	Specific Gravity	Per cent Na_2SO_4 + 10 aq.	Per cent Na_2SO_4
1,0040	1	0,441	1,0439	11	4,851	1,0849	21	9,261
1,0079	2	0,881	1,0479	12	5,292	1,0890	22	9,702
1,0118	3	1,323	1,0520	13	5,373	1,0931	23	10,143
1,0158	4	1,764	1,0560	14	6,174	1,0973	24	10,584
1,0198	5	2,205	1,0601	15	6,615	1,1015	25	11,025
1,0238	6	2,646	1,0642	16	7,056	1,1057	26	11,466
1,0278	7	3,087	1,0683	17	7,497	1,1100	27	11,907
1,0318	8	3,528	1,0725	18	7,938	1,1142	28	12,348
1,0358	9	3,969	1,0766	19	8,379	1,1184	29	12,789
1,0398	10	4,410	1,0807	20	8,820	1,1226	30	13,230

Sodium Nitrite $NaNO_2$, mol. weight 69, is put upon the market in crystals, and is easily soluble. It is used in diazotising ice colours. It is necessary to make an analysis of the salt before use, in order to determine the amount of nitrite, required for diazotising. The analysis is made by titration with Permanganate of potassium.

Sodium Phosphate. The common Sodium phosphate, $Na_2HPO_4 + 12H_2O$, molec. weight 358, (soluble in 35 parts of cold and 1 part of hot water) forms decomposing crystals which easily crumble away. It is used in dyeing and printing with direct colours, for fixing alumina mordants upon Alizarine Red, and for neutralizing Diazo solutions of insoluble Azo Colours produced on the fibre.

Sodium Pyrophosphate $Na_4P_2O_7 + 10H_2O$, mol. weight 446, (soluble in 20 parts of cold and 1 part of hot water), forms white crystals and is used in discharging Alpha Naphthylamine Claret with Hydrosulphite NF.

Sodium Borate or Borax $Na_2B_4O_7 + 10H_2O$, mol. weight 382 (soluble in 15 parts of cold and $^1/_2$ part of hot water), forms large monocline prisms, and, owing to its slightly alkaline character, serves as a solvent for the Alizarine dyestuffs in padding.

Sodium Silicate or Waterglass, $Na_2Si_4O_9$, mol. weight 302, is put upon the market as a thick liquid of $66^1/_2$—77° Tw. or in the solid state, and is used for dunging, also as an addition to white discharges on Turkey red, and for the alkali-boiling process in bleaching cotton fabrics.

Sodium Acetate, $NaC_2H_3O_2 + 3H_2O$, mol. weight 136 (soluble in 3 parts cold and in $^1/_2$ part hot water), is obtained by neutralizing acetic acid with caustic soda, and crystallizes in rhombic columns. It is used as an addition to the Diazo solutions in printing and dyeing with ice colours, and for neutralizing mineral acids. Moreover, as an addition to tin salt discharges, for Aniline Black resists, and also for rinsing goods dyed with Sulphur colours.

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10. POTASSIUM-COMPOUNDS.

Potassium Hydroxide or **Caustic Potash** KOH, mol. weight 56, forms a white crystalline substance, and is sometimes preferred to caustic soda in Indigo printing, owing to is greater solubility.

Potassium Carbonate or **Potash** $K_2CO_3 + 2H_2O$, mol. weight 174, is easily soluble in water, and forms a white hygroscopic substance. It is a fairly strong alkali, and is used in dyeing and printing.

Potassium Chlorate $KClO_3$, mol. weight 122,5 (soluble in 14 parts of cold and in 2 parts of hot water), forms transparent monocline tablets, and is used for oxidizing. Although little soluble, it is used instead of sodium chlorate on account of its lower price.

Potassium Pyrosulphite or **Potassium Metasulphite** $K_2S_2O_5$, mol. weight 222, is a stable preparation of sulphite in form of powder, which is used for dyeing Turkey Red, by a simplified method, patented by the Farbwerke Hoechst.

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11. AMMONIUM-COMPOUNDS.

Ammonia or **Spirits of Ammonia,** NH_3, mol. weight 17. The name of Ammonia is applied to a solution of gaseous Ammonia in water. It is usually put upon the market as a solution of 25 %. It is a fugitive base, and used for the most varied purposes in dyeing and printing.

Specific Gravity of solutions of Ammonia at 59° F referred to water of 59° F. = 1.

(Lunge and Wiernik.)

The figures for correction in column 4 apply to the difference of temperature between 55—63° F. e. g, if, at 55°, the specific gravity is found to be 0,900, it must be put at 59° as $2 \times 0{,}00057 = 0{,}001$ less, which then gives the specific gravity as 0,899, by which the proportion of ammonia becomes $^1/_3$% higher.

Specific Gravity	Per cent NH_3	1 litre contains grs. NH_3 at 59° F	Correction for $\pm 1^4/_5$° F	Specific Gravity	Per cent NH_3	1 litre contains grs NH_3 at 59° F	Correction for $\pm 1^4/_5$° F
1,000	0,00	0,0	0,00018	0,940	15,63	146,9	0,00039
0,998	0,45	4,5	0,00018	0,938	16,22	152,1	0,00040
0,996	0,91	9,1	0,00019	0,936	16,82	157,4	0,00041
0,994	1,37	13,6	0,00019	0,934	17,42	162,7	0,00041
0,992	1,84	18,2	0,00020	0,932	18,03	168,1	0,00042
0,990	2,31	22,9	0,00020	0,930	18,64	173,4	0,00042
0,988	2,80	27,7	0,00021	0,928	19,25	178,6	0,00043
0,986	3,30	32,5	0,00021	0,926	19,87	184,2	0,00044
0,984	3,80	37,4	0,00022	0,924	20,49	189,3	0,00045
0,982	4,30	42,2	0,00022	0,922	21,12	194,7	0,00046
0,980	4,80	47,0	0,00023	0,920	21,75	200,1	0,00047
0,978	5,30	51,8	0,00023	0,918	22,39	205,6	0,00048
0,976	5,80	56,6	0,00024	0,916	23,03	210,9	0,00049
0,974	6,30	61,4	0,00024	0,914	23,68	216,3	0,00050
0,972	6,80	66,1	0,00025	0,912	24,33	221,9	0,00051
0,970	7,31	70,9	0,00025	0,910	24,99	227,4	0,00052
0,068	7,82	75,7	0,00026	0,908	25,65	232,9	0,00053
0,966	8,33	80,5	0,00026	0,906	26,31	238,3	0,00054
0,964	8,84	85,2	0,00027	0,904	26,98	243,9	0,00055
0,962	9,35	89,9	0,00028	0,902	27,65	249,4	0,00056
0,960	9,91	95,1	0,00029	0,900	28,33	255,0	0,00057
0,958	10,47	100,3	0,00030	0,898	29,01	260,5	0,00058
0,956	11,03	105,4	0,00031	0,896	29,69	266,0	0,00059
0,954	11,60	110,7	0,00032	0,894	30,37	271,5	0,00060
0,952	12,17	115,9	0,00033	0,892	31,05	277,0	0,00060
0,950	12,74	121,0	0,00034	0,890	31,75	282,6	0,00061
0,948	13,31	126,2	0,00035	0,888	32,50	288,6	0,00062
0,946	13,88	131,3	0,00036	0,886	33,25	294,6	0,00063
0,944	14,46	136,5	0,00037	0,884	34,10	301,4	0,00064
0,942	15,04	141,7	0,00038	0,882	34,95	308,3	0,00065

Ammonium Chloride, NH_4Cl., mol. weight 53,4, (soluble in 3 parts of cold and in 1 ½ parts of hot water), is put upon the market in white crystals. The solutions of Ammonium chloride in water dissociate, when heated, into the fugitive ammonia and hydrochloric acid. In printing use is made of this property of acting as an acid in its gaseous state.

Ammonium Sulphocyanide NH_4SCN, mol. weight 76, forms colourless, easily soluble hygroscopic leaves. It is used as an addition to tin salt discharges, where it counteracts the hydrochloric acid formed, and thus prevents corrosion of the fibre. It may also be employed in resists under Aniline Black and other oxidizing colours.

* * *

12. MAGNESIUM-COMPOUNDS.

Magnesium Oxide or **Burnt Magnesia** MgO, mol. weight 40, forms a white amorphous powder which is used for producing the various magnesium mordants.

Magnesium Carbonate $MgCO_3$, mol. weight 84, is used in printing resists under Aniline Black.

Magnesium Chloride $MgCl_2 + 6H_2O$, mol. weight 203, is put upon the market either in crystals or calcined, and dissolves easily in water. Owing to its hygroscopic character it is used as an addition to finishes, in order to retain moisture in finished goods.

Magnesium Sulphate or **Epsom salt** $MgSO_4 + 7H_2O$, mol. weight 246 (soluble in 4 parts of cold and in 1 ½ parts of hot water), is chiefly used for finishing cotton goods.

Magnesium Acetate $Mg(C_2H_3O_2)_2 + 4H_2O$, mol. weight 214, is obtained by dissolving magnesium carbonate in acetic acid. It is used in solution of 40° Tw. as a resist for Aniline Black.

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13. CALCIUM-COMPOUNDS.

Calcium Oxide, Caustic Lime, Quick Lime or **Burnt Lime** CaO, mol. weight 56, is obtained by burning calcium carbonate. It forms a white amorphous and porous substance which in absorbing moisture develops heat. By the action of water upon quick lime calcium hydroxide (slaked lime) is generated, which is employed in bleaching, vat dyeing, for producing calcium mordants, etc.

Quantities of Calcium Oxide in Milk of Lime at 59° F.

(Lunge and Blattner.)

Degrees Beaumé	Weight of 1 litre in grs	CaO in 1 litre grs	CaO Weight Per cent	Degrees Beaumé	Weight of 1 litre in grs	CaO in 1 litre grs	CaO Weight Per cent
1	1007	7,5	0,745	16	1125	159	14,13
2	1014	16,5	1,64	17	1134	170	15,00
3	1022	26	2,54	18	1142	181	15,85
4	1029	36	3,54	19	1152	193	16,75
5	1037	46	4,43	20	1162	206	17,72
6	1045	56	5,36	21	1171	218	18,61
7	1052	65	6,18	22	1180	229	19,40
8	1060	75	7,08	23	1190	242	20,34
9	1067	84	7,87	24	1200	255	21,25
10	1075	94	8,74	25	1210	268	22,15
11	1083	104	9,60	26	1220	281	23,03
12	1091	115	10,54	27	1231	295	23,96
13	1100	126	11,45	28	1241	309	24,90
14	1108	137	12,35	29	1252	324	25,87
15	1116	148	13,26	30	1263	339	26,84

Calcium Carbonate or **Chalk,** $CaCO_3$, mol. weight 100, serves for neutralizing, e. g. it neutralizes the acid which is liberated in fixing Basic Colours with Tartar Emetic and is used as an addition to Alizarine Red dyebaths.

Chloride of Lime, $CaOCl_2$, mol. weight 127, is put upon the market as a smooth white powder, free from any hard lumps. In the open air it absorbs moisture and carbonic acid, and becomes soft and greasy. It dissolves in 20 parts water. In dissolving it leaves an insoluble residue of caustic lime. Chloride of lime must be kept in well closed vessels and in a dry place. Its chief use is in bleaching. Chloride of lime should contain about 35 % effective chlorine. The analysis is made by titration with arsenous acid.

Specific Gravity of Solutions of Chloride of Lime at 59° F.

Specific Gravity	Degrees Bé	Grs effective chlorine per litre	Specific Gravity	Degrees Bé	Grs effective chlorine per litre
1,105	13,6	64	1,045	6	30
1,097	12,6	60	1,037	5	25
1,087	11,5	55	1,030	4	20
1,078	10,4	50	1,023	3	15
1,069	9,2	45	1,015	2	10
1,060	8	40	1,008	1	5
1,053	7	35			

Diluted Solutions of Chloride of Lime, e. g. such as are used in bleaching, cannot be reliably determined by the areometer. The following method is sufficient for practical purposes, and is specially suitable for controlling the chemicking operations:

An Indigo solution is prepared with

15 g Indigo Carmine paste
10 g sulphuric acid 169° Tw., made up to 1 litre.

A portion of chloride of lime solution $^{3}/_{4}$° Tw. mixed with an equal volume of above solution effects decoloration.

Table showing the proportions of chlorine in weak solutions of chloride of lime.
(G. Lunge and F. Bachofen.)

Degrees Tw.	Specific Gravity	Grs effective chlorine per litre
	1,0150	8,48
3 →		
	1,0100	5,58
$1^{1}/_{2}$ →		
1 →	1,0050	2,71
$^{3}/_{4}$ →		
	1,0025	1,40
$^{3}/_{8}$ →		
	1,0000	Trace

Calcium Acetate or **Acetate of Lime** $Ca(C_2H_3O_2)_2 + H_2O$, mol. weight 176, is produced from burnt lime and acetic acid in the following manner:

35 lbs (3,5 kos) pure burnt lime are slaked with
5 gall (5 litres) water, and diluted with
7 gall (7 litres) water. Then are added
20 gall (20 litres) acetic acid 9° Tw., and allowed to stand for 12 to 24 hours.

The clear alkaline solution is drained off from the sediment (containing iron), then acetic acid is added until a slight acid reaction sets in, and finally the solution reduced to $28^1/_2{}^0$ Tw.

It is used as an addition to Alizarine steam Colours, especially to Alizarine Red and Pink, for which purpose it must be perfectly free from iron.

Specific Gravity of Solutions of Calcium Acetate at 59° F.

Specific Gravity	Degrees Bé	Per cent $Ca(C_2H_3O_2)_2$	Specific Gravity	Degrees Bé	Per cent $Ca(C_2H_3O_2)_2$
1,0260	3,4	5	1,1051	13,6	20
1,0530	7,1	10	1,1321	16,8	25
1,0792	10,5	15	1,1594	19,8	30

Pyrolignate of Lime is put upon the market in brown lumps, and is produced by neutralization of pyroligneous acid with Milk of lime. Owing to its lower price it is used for the preparation of aluminium- and chrome mordants.

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14. ALUMINIUM-COMPOUNDS.

Sodium Aluminate, $Na_2Al_2O_4$, mol. weight 164, is obtained by dissolving freshly precipitated alumina hydrate in caustic soda. It is used as a mordant for Alizarine Red.

Aluminium Chloride, Al_2Cl_6, mol. weight 266,5, is used as a solution of 53° Tw., and on account of its easy dissociation, it is frequently employed for printing colours produced upon the fibre by oxidation.

Aluminium Sulphate or **Sulphate of Alumina,** $Al_2(SO_4)_3 + 18H_2O$, mol. weight 664,8 (soluble in 10 parts of cold and $^1/_{10}$ parts of hot water), is a substitute for alum. It is used for the production of various aluminium mordants, and for that reason must be free from iron.

Specific Gravity of Solutions of Aluminium Sulphate at 59° F.

Specific Gravity	Per cent $Al_2(SO_4)_3$	Specific Gravity	Per cent $Al_2(SO_4)_3$	Specific Gravity	Per cent $Al_2(SO_4)_3$
1,0170	1	1,1071	10	1,1971	19
1,0270	2	1,1171	11	1,2074	20
1,0370	3	1,1270	12	1,2168	21
1,0470	4	1,1369	13	1,2274	22
1,0569	5	1,1467	14	1,2375	23
1,0670	6	1,1574	15	1,2473	24
1,0768	7	1,1668	16	1,2573	25
1,0870	8	1,1770	17		
1,0968	9	1,1876	18		

Potassium Aluminium Sulphate or **Potash Alum,** $K_2SO_4 \cdot Al_2(SO_4)_3 + 24H_2O$, mol. weight 948 (soluble in 10 parts of cold and $^1/_4$ part of hot water), forms large colourless octahedra. Like sulphate of alumina it is used for the production of aluminium mordants.

Specific Gravity of Solutions of Potash Alum at 63° F.

(Gerlach)

Specific Gravity	Per cent $Al_2K_2(SO_4)_4$	Per cent $Al_2K_2(SO_4)_4 + 24H_2O$	Specific Gravity	Per cent $Al_2K_2(SO_4)_4$	Per cent $Al_2K_2(SO_4)_4 + 24H_2O$
1,0205	2,1792	4	1,0635	6,5379	12
1,0415	4,3548	8	1,0690	7,0824	13

Ammonium Aluminium Sulphate or **Ammonia Alum,** $(NH_4)_2SO_4 \cdot Al_2(SO_4)_3 + 24H_2O$, mol. weight 904,4 (soluble in 10 parts of cold water and very soluble in hot water), forms large colourless octahedra. It is used instead of potash alum for the production of aluminium mordants.

Aluminium Acetate or **Acetate of Alumina,** $Al_2(C_2H_3O_2)_6$, mol. weight 408, is obtained by dissolving aluminium hydrate in acetic acid, or by the interaction of aluminium sulphate or alum and sugar of lead or acetate of lime. Basic aluminium acetates are obtained by adding soda solutions to the normal aluminium acetate. The more basic they are, the more easily they dissociate when heated. The precipitates thus obtained do not dissolve again on cooling. Diluted with water the aluminium acetates do not dissociate. — In the presence of alkali sulphates, however, both the normal aluminium acetate, and the basic aluminium acetates dissociate when diluted with water; they are also much easier split up when heated, but the precipitates thereby obtained dissolve again on cooling. The basic aluminium acetates are usually obtained by the interchange of sulphate of alumina with sugar of lead and soda. In this case an alkali sulphate is present, and the product consequently dissociates easily. Acetate of alumina is used as a mordant in dyeing, and for waterproofing.

I.

1250 g Alumina hydrate 12 % are heated with
1000 g acetic acid 9° Tw., filtered, and diluted with
water to 15° Tw.

II.

$\begin{cases} \text{665 parts sulphate of alumina,} \\ \text{1000 parts water,} \end{cases}$
$\begin{cases} \text{1137 parts sugar of lead,} \\ \text{1000 parts water} \end{cases}$

each to be separately dissolved hot, precipitated and diluted to 15° Tw.

Specific Gravity of Solutions of Acetate of Alumina at 63° F.

Specific Gravity	Degrees Bé	grs Al_2O_3 per litre	Specific Gravity	Degrees Bé	grs Al_2O_3 per litre
1,100	13,0	40,8	1,050	6,7	20
1,098	12,8	40	1,038	5,0	15
1,086	11,3	35	1,025	3,4	10
1,074	9,9	30	1,012	1,6	5
1,062	8,3	25			

Aluminium Sulpho-Acetate or **Sulphate-Acetate of Alumina** is obtained when a quantity of sugar of lead insufficient for completing the chemical interchange is used. The normal sulpho-acetate does not dissociate on being diluted with water. When heated, it forms a precipitate which dissolves again on cooling, whereas the basic sulpho-acetates dissociate both when diluted with water and when slightly heated. The precipitates thereby obtained do not dissolve again on cooling. The normal sulpho-acetate is used in printing, the basic aluminium acetates in dyeing with Alizarine Red.

1. Normal Sulpho-Acetate.

6650 parts sulphate of alumina,
6000 parts water
9450 parts sugar of lead
9000 parts water

each to be separately dissolved hot, precipitated and diluted to 15° Tw.

2. Basic Sulpho-Acetate.

1908 parts Alum or 1336 g acetate of alumina
2000 parts water
1590 parts sugar of lead
1600 parts water

each to be separately dissolved hot, and precipitated.

After cooling

150 parts crystal soda are added and

the whole left to stand for 24 hours, decanteded and diluted to 18° Tw.

Aluminium Sulpho-Cyanide $Al_2(CNS)_6$, mol. weight 402, is produced from sulphate of alumina and cyanide of barium. As it does not corrode the steel doctors in printing, and slight impurities of iron in the mordant are counteracted by it, it is used as a mordant for Alizarine Red and Alizarine Pink. It also acts as a resist for Aniline Black.

Sulpho-Cyanide of Aluminium 18° Tw.

6300 parts sulphate of alumina, dissolved in
10000 parts water
8500 parts cyanide of barium, dissolved in
10000 parts water

are mixed, decanted and filtered, and the filtered liquid is diluted to 18° Tw.

Aluminium Nitrate $Al_2(NO_3)_6 + 15H_2O$, mol. weight 694,7, forms easily soluble crystals, and is obtained by dissolving aluminium hydrate in nitric acid, or by the interchange of sulphate of alumina with nitrate of lead. It dissociates neither by heating nor by dilution with water, and is used as a mordant for Alizarine Red Steam Colours.

Aluminium Nitro-Acetate or **Nitrate-Acetate of Alumina, Nitrate Mordant,** is obtained by a double interchange of sulphate of alumina or alum with sugar of lead and nitrate of lead, or with acetate and nitrate of lime. It dissociates very slowly in steaming, and is therefore suitable as a mordant for Alizarine Red.

Nitrate Mordant.

667 parts sulphate of alumina are dissolved in
1000 parts water; then are added
786 parts acetate of lime 23° Tw. and
886 parts nitrate of lime 67° Tw.

the whole diluted to 3200 parts and filtered. Or

6 parts alum are precipitated with
4 parts sugar of lead and
2 parts nitrate of lead.

Tartrate of Alumina 23° Tw.

1500 parts Alumina hydrate 50% are made into paste with
2200 parts hot water, to which is added a solution of
720 parts tartaric acid dissolved in
1500 parts water.

After heating the solution is diluted to 23° Tw.

15. CHROMIUM-COMPOUNDS.

Chrome Alum $K_2SO_4 \cdot Cr_2(SO_4)_3 + 24H_2O$, mol. weight 999, is put upon the market in dark violet octahedra. It is used for the preparation of chrome mordants.

Bisulphite of Chrome, $Cr(HSO_3)_3$? is obtained by mixing a chrome alum solution with bisulphite. It is decomposed by steaming under formation of chromium hydrate. It is used as a mordant in dyeing.

Specific Gravity of Solutions of Chrome Bisulphite at 63° F.

Specific Gravity	Degrees Bé	grs Cr_2O_3 per litre	Specific Gravity	Degrees Bé	grs Cr_2O_3 per litre
1,160	19,8	80	1,080	10,6	40
1,150	18,8	75	1,070	9,4	35
1,140	17,7	70	1,060	8,0	30
1,130	16,5	65	1,050	6,7	25
1,120	15,4	60	1,040	5,4	20
1,110	14,2	55	1,030	4,1	15
1,100	13,0	50	1,020	2,7	10
1,090	11,9	45	1,010	1,4	5

Acetate of Chrome, $Cr_2(C_2H_3O_2)_6$, mol. weight 458,6, is obtained by dissolving chromium hydrate in acetic acid, by the reaction of chrome alum upon sugar of lead or acetate of lime, or by the reduction of bichromate of potassium with glucose. Two modifications of acetate of chrome are sold: the green or normal acetate, $Cr_2(CH_3COO)_6$, and the violet or basic acetate, $Cr_2(CH_3COO_4)_4(OH)_2$. An addition of sodium acetate to acetate of chrome diminishes its faculty of being precipitated by alkalies. It is not easily decomposed. Basic chrome acetates are obtained by an addition of soda to normal acetate of chrome. Only very basic acetates dissociate on heating. The green acetate of chrome is used for the production of Mineral Khaki-shades.

Directions for preparing acetate of chrome.

I. 1200 parts chromium hydrate and
1300 parts acetic acid 9° Tw. are heated on the water bath until completely dissolved, and diluted to 25° Tw.

II. 1200 parts chrome alum
2400 parts water
1200 parts sugar of lead
1000 parts water

are precipitated, filtered and washed, and then diluted to $32^1/_2$° Tw.

III. 1200 parts sodium bichromate
1250 parts water
3000 parts acetic acid 9° Tw., to which are gradually added
756 parts glucose

are heated until the solution shows a green colour, and then diluted to $32^1/_2$° Tw.

Certain dyestuffs which require to be dissolved in alkalies, can only be used in combination with neutral acetate of chrome. This is produced as follows:

1000 parts acetate of chrome $32^1/_2$° Tw.
20 parts glycerine
8 parts soda
72 parts water.

Specific Gravity of Solutions of Normal (Green) Sextuple Acetate of Chrome at 63° F.

Specific Gravity	Degrees Bé	grs Cr_2O_3 per litre	Specific Gravity	Degrees Bé	grs Cr_2O_3 per litre
1,007	1	5	1,084	11,1	60
1,014	2	10	1,091	12,0	65
1,021	3	15	1,098	12,8	70
1,028	4	20	1,105	13,6	75
1,035	4,9	25	1,112	14,5	80
1,042	5,8	30	1,119	15,3	85
1,049	6,6	35	1,126	16,1	90
1,056	7,5	40	1,133	16,9	95
1,063	8,4	45	1,140	17,6	100
1,070	9,3	50	1,147	18,5	105
1,077	10,2	55	1,151	19	107

Specific Gravity of Solution of Basic (Violet) Acetate of Chrome at 59° F.

Specific Gravity	Degrees Bé	grs Cr_2O_3 per litre	Specific Gravity	Degrees Bé	grs Cr_2O_3 per litre
1,006	1,0	5	1,089	11,8	70
1,013	2,0	10	1,096	12,5	75
1,019	2,7	15	1,102	13,	80
1,025	3,4	20	1,108	13,9	85
1,031	4,2	25	1,115	14,9	90
1,037	5,0	30	1,122	15,7	95
1,043	5,8	35	1.129	16,4	100
1,050	6,7	40	1,136	17,2	105
1,056	7,5	45	1,143	18,0	110
1,063	8,4	50	1,150	18,8	115
1,069	9,3	55	1,157	19,5	120
1,076	10,1	60	1,161	19,9	122
1,083	11,0	65			

Alkaline Chrome Mordants. I. An easily fixable mordant for chrome colours has been prepared by Horace Köchlin by mixing:

250	parts acetate of chrome 32½° Tw.
320	parts caustic soda 71½° Tw.
10	parts glycerine 53° Tw.
420	parts water
1000	parts.

II. According to Henri Schmid an alkaline mordant can be obtained by dissolving chromium hydrate in caustic soda:

1000 parts chrome alum are precipitated with
330 parts calc. soda; the precipitate is washed
and then dissolved in
50 parts caustic soda 53° Tw.

By means of alkaline chrome mordants the chromoxide is readily affixed to the cotton fibre; full shades are thus obtained in dyeing without the use of further fixing mediums.

Chrome Mordants GA I, GA II, GA III, (according to M. von Gallois), are obtained either by dissolving chromium hydrate in chromic acid, alone or mixed with hydrochloric acid or acetic acid. They can also be obtained by a double chemical interchange. The brand GA II, which contains acetic acid, is used specially in cotton dyeing. As it affixes its chromoxide to the fibre readily it is well adapted as a mordant in dyeing.

Specific Gravity of Solutions of Chrome Mordant GAI at 59° F.

Specific Gravity	Degrees Beaumé	g Cr_2O_3 per litre	Specific Gravity	Degrees Beaumé	g Cr_2O_3 per litre	Specific Gravity	Degrees Beaumé	g Cr_2O_3 per litre
1,012	1,7	10	1,121	15,5	110	1,230	26,9	210
1,023	3,1	20	1,132	16,7	120	1,241	28,0	220
1,034	4,6	30	1,143	18,1	130	1,252	29,0	230
1,045	6,0	40	1,154	19,2	140	1,263	30,0	240
1,056	7,6	50	1,165	20,3	150	1,274	31,0	250
1,067	9,0	60	1,176	21,5	160	1,285	32,0	260
1,078	10,4	70	1,187	22,7	170	1,296	32,9	270
1,089	11,8	80	1,198	23,8	180	1,307	33,9	280
1,099	12,9	90	1,208	24,8	190	1,318	34,9	290
1,110	14,2	100	1,219	25,9	200	1,325	35,4	296

Specific Gravity of Solutions of Chrome Mordant GAII, at 59° F.

Specific Gravity	Degrees Beaumé	g Cr_2O_3 per litre	Specific Gravity	Degrees Beaumé	g Cr_2O_3 per litre	Specific Gravity	Degrees Beaumé	g Cr_2O_3 per litre
1,015	2,1	10	1,125	16,0	120	1,235	27,4	230
1,025	3,4	20	1,135	17,1	130	1,245	28,4	240
1,035	4,7	30	1,145	18,3	140	1,250	29,4	250
1,045	6,0	40	1,155	19,3	150	1,266	30,3	260
1,055	7,4	50	1,165	20,3	160	1,276	31,3	270
1,065	8,7	60	1,175	21,4	170	1,287	32,2	280
1,075	10,0	70	1,185	22,5	180	1,298	33,2	290
1,085	11,2	80	1,195	23,5	190	1,309	34,1	300
1,095	12,4	90	1,205	24,5	200	1,320	35,1	310
1,105	13,6	100	1,215	25,5	210	1,328	35,7	317,4
1,115	14,9	110	1,225	26,5	220			

Specific Gravity of Solutions of Chrome Mordant GAIII, at 59° F.

Specific Gravity	Degrees Beaumé	g Cr_2O_3 per litre	Specific Gravity	Degrees Beaumé	g Cr_2O_3 per litre	Specific Gravity	Degrees Beaumé	g Cr_2O_3 per litre
1,011	1,6	10	1,118	15,2	110	1,224	26,3	210
1,022	3,0	20	1,128	16,4	120	1,235	27,4	220
1,033	4,5	30	1,139	17,6	130	1,246	28,5	230
1,044	5,9	40	1,149	18,7	140	1,256	29,4	240
1,055	7,4	50	1,159	19,7	150	1,267	30,4	250
1,065	8,7	60	1,170	20,9	160	1,278	31,4	260
1,076	10,1	70	1,181	22,1	170	1,289	32,2	270
1,086	11,3	80	1,191	23,1	180	1,300	33,3	280
1,097	12,6	90	1,202	24,2	190	1,311	34,3	290
1,108	13,9	100	1,219	25,3	200	1,316	34,7	296

Sodium Bichromate, $Na_2Cr_2O_7 + 2H_2O$, mol. weight 299, forms deliquescent crystals, and is preferred to potassium bichromate on account of its greater solubility in chromate discharges on Indigo, also for chroming baths and for the production of various chrome mordants.

Potassium Bichromate, $K_2Cr_2O_7$, mol. weight 295 (soluble in 8 parts of cold and 1 part of hot water), forms orange red triclinic crystals. Like sodium bichromate it is used for Indigo discharges, for the preparation of chrome mordants, and for chroming baths.

Fluoride of Chrome $Cr_2Fl_6 + 8H_2O$, mol. weight 362, is a green crystalline powder, easily soluble in water, and has a corrosive action upon metals. It is used for aftertreating Dianil- and Thiogene colours, in order to increase their fastness.

16. IRON-COMPOUNDS.

Chloride of Iron, Fe_2Cl_6, mol. weight 325, is put upon the market in easily deliquescent tablets, and is used in an alkaline solution as a medium for oxidation.

Ferrous Sulphate or **Copperas,** $FeSO_4 + 7H_2O$, mol. weight 278 (soluble in 2 parts of cold and $^1/_3$ part of hot water), forms greenish blue, monoclinic crystals which are very efflorescent. It is used for the preparation of the various iron mordants.

Specific Gravity of Solutions of Ferrous Sulphate, at 59° F.

Specific Gravity	Per cent $FeSO_4 + 7H_2O$	Specific Gravity	Per cent $FeSO_4 + 7H_2O$	Specific Gravity	Per cent $FeSO_4 + 7H_2O$
1,011	2	1,054	10	1,143	25
1,021	4	0.065	12	1,174	30
1,032	6	1,082	15	1,206	35
1,043	8	1,112	20	1,239	40

Ferrous Acetate or **Acetate of Iron,** $Fe(C_2H_3O_2)_2 + 4H_2O$, mol. weight 246, is obtained by dissolving iron in acetic acid, or by the double decomposition of copperas with sugar of lead:

68 lbs sulphate of iron
36 lbs sugar of lead
are dissolved together in water. After being allowed to stand, the liquid is filtered and diluted to 32 ½ ° Tw.
180 (18 Gall.)

Ferrous Acetate is used specially for the production of buff and tan shades, and in combination with chrome salts, for the production of khaki shades.

Pyrolignate of Iron is obtained by dissolving iron in pyroligneous acid (wood-vinegar) or by the double decomposition of sulphate of iron with pyrolignate of lime. It is extensively used as a mordant in dyeing and for Steam Alizarine Violet.

Specific Gravity of Solutions of Pyrolignate of Iron at 65° F.

Specific Gravity	Degrees Beaumé	grs. Fe_2O_3 per litre	Specific Gravity	Degrees Beaumé	grs. Fe_2O_3 per litre	Specific Gravity	Degrees Beaumé	grs. Fe_2O_3 per litre
1,274	31.0	190	1,179	21.9	125	1,088	11,7	60
1,266	30.3	185	1,172	21,2	120	1,081	10,7	55
1.258	29.5	180	1,165	20,3	115	1,074	9,9	50
1,250	28,8	175	1,158	19,6	110	1,067	9,0	45
1,242	28.0	170	1,151	18,9	105	1,060	8,0	40
1,235	27,4	165	1,144	18,2	100	1,053	7,1	35
1,228	26.7	160	1,137	17,4	95	1,046	6,1	30
1,221	26,1	155	1,130	16,5	90	1,039	5,2	25
1,214	25,4	150	1,123	15,7	85	1,032	4,3	20
1,207	24,7	145	1,116	15,0	80	1,025	3,4	15
1,200	24.0	140	1,109	14,1	75	1,018	2,4	10
1,193	23,3	135	1,102	13,2	70	1,010	1,4	5
1,186	22,6	130	1,095	12,4	65			

Basic Sulphate of Iron, commercially known as Nitrate of Iron, is put upon the market as a darkbrown liquid of 91° Tw., and is obtained by the reaction of nitric acid upon iron vitriol. It serves the same purposes as pyrolignate of iron.

Potassium Ferrocyanide or Yellow Prussiate, $K_4FeCy_6 + 3H_2O$, mol. weight 322 (soluble in 3 parts of cold and 1 part of hot water), forms lemon-coloured monoclinic tablets. It is used as a carrier of oxygen in printing and padding with Steam Aniline Black, and as an addition to oxidizing discharges. Also as a mordant for Steam Alizarine Violet.

Potassium Ferrocyanide or Red Prussiate, $K_6Fe_2Cy_{12}$, mol. weight 658 (soluble in $2^1/_2$ parts of cold and $1^1/_2$ parts of hot water), forms dark red rhombic prisms. It is used, like yellow prussiate as a carrier of oxygen, and, aftertreated with caustic soda, for Indigo discharges.

17. ZINC AND CADMIUM-COMPOUNDS.

Zinc dust is put upon the market as a finely subdivided grey powder, consisting of metallic zinc and some oxide of zinc; it is a strongly reducing medium, and is largely used for setting Indigo vats, for preparing hydrosulphite, bisulphite-zinc dust discharges etc.

Sulphate of Zinc, $ZnSO_4 + 7H_2O$, mol. weight 287 (soluble in 1 part of cold and $^1/_6$ part of hot water), is put upon the market in white crystals which are very efflorescent. It is used as a mordant for Alizarine Blue S, for aftertreating Melanogen Blue etc.

Specific Gravity of Solutions of Sulphate of Zinc at 59° F.

(Gerlach.)

Specific Gravity	Degrees Bé	Per cent $ZnSO_4$	Per cent $ZnSO_4 + 7H_2O$	Specific Gravity	Degrees Bé	Per cent $ZnSO_4$	Per cent $ZnSO_4 + 7H_2O$
1,0288	3,8	2,805	5	1,2315	27,0	19,637	35
1,0593	8,0	5,611	10	1,2709	30,7	22,443	40
1,0905	12,0	8,416	15	1,3100	34,2	25,248	45
1,1236	17,2	11,220	20	1,3532	37,6	28,054	50
1,1574	19,5	14,027	25	1,3986	41,0	30,859	55
1,1933	23,3	16,832	30	1,4451	44,4	33,664	60

Sulphate of Cadmium, $CdSO_4 + 2{,}66H_2O$, mol. weight 256,4 forms white crystals which are efflorescent. It is used for aftertreating Melanogen Blue.

Fixing Salt M is a mixture of cadmium sulphate, sulphate of zinc and alum which is also used for aftertreating Melanogen Blue.

18. NICKEL, MANGANESE AND LEAD-COMPOUNDS.

Sulphate of Nickel, $NiSO_4 + 7H_2O$, mol. weight 281, is put upon the market in green, easily soluble crystals and is used for the preparation of various nickel mordants.

Potassium Permanganate, mol. weight 153 (soluble in 15 parts of cold water, and very easily in hot water), forms dark violet, nearly black crystals with a steel blue lustre. It is a strong oxidizer in acid, alkaline and neutral solutions.

Nitrate of Lead, $Pb(NO_3)_2$, mol. weight 330, (soluble in 2 parts of cold and 1 part of hot water), forms white crystals, and is used for the preparation of nitrate mordants.

Acetate of Lead or **Sugar of Lead,** $Pb(CH_3COO)_2 + 3H_2O$, mol. weight 379 (soluble in 1½ parts of cold and ½ part of hot water), is put upon the market in white crystals, and is used for the preparation of acetate mordants.

Specific Gravity of Solutions of Sugar of Lead at 68° F.

(F. Salomon.)

Grammes in 100 cc	Specific Gravity	Grammes in 100 cc	Specific Gravity	Grammes in 100 cc	Specific Gravity
1	1,0062	18	1,1118	35	1,2142
2	1,0124	19	1,1180	36	1,2201
3	1,0186	20	1,1242	37	1,2261
4	1,0248	21	1,1302	38	1,2320
5	1,0311	22	1,1362	39	1,2380
6	1,0373	23	1,1422	40	1,2440
7	1,0435	24	1,1482	41	1,2499
8	1,0497	25	1,1543	42	1,2558
9	1,0559	26	1,1603	43	1,2617
10	1,0622	27	1,1663	44	1,2676
11	1,0684	28	1,1723	45	1,2735
12	1,0746	29	1,1783	46	1,2794
13	1,0808	30	1,1844	47	1,2853
14	1,0870	31	1,1903	48	1,2912
15	1,0932	32	1,1963	49	1,2971
16	1,0994	33	1,2022	50	1,3030
17	1,1056	34	1,2082		

Basic acetate of lead, is obtained by boiling solutions of sugar of lead with lead oxide. It is used for the preparation of Chrome Orange.

◆

19. COPPER, ANTIMONY AND TIN-COMPOUNDS.

Chloride of Copper, $CuCl_2 + 2H_2O$, mol. weight 170, is a very powerful carrier of oxygen, and is used for Aniline- and Diphenyl Black discharges.

Sulphide of Copper, CuS, mol. weight 95,5, is used as a carrier of oxygen for colours produced upon the fibre by oxidation.

It is prepared as follows:

3750 parts copper vitriol, dissolved in
15000 parts water,
3900 parts sodium sulphide cryst., dissolved in
10000 parts water.

Both solutions are mixed simultaneously with about 20000 parts of cold water; then the precipitate is filtered, washed and pressed until 5400 parts paste are obtained.

Or:

500 parts sulphur
3500 parts caustic soda $66\frac{1}{2}^0$ Tw.
2000 parts sulphate of copper
8000 parts water

are precipitated hot, decanted twice, washed and pressed to 2500 parts – 30% paste.

When exposed to air or heat for some time copper sulphide changes into copper sulphate. For that reason it should be kept covered with a wet cloth.

Sulphate of Copper or **Bluestone** $CuSO_4 + 5H_2O$, mol. weight 249 (soluble in $2\frac{1}{2}$ parts of cold and $\frac{1}{2}$ part of hot water), is put upon the market in beautiful blue triclinic crystals, and is chiefly used for aftertreating colours in order to make them faster to light.

Specific Gravity of Solutions of Copper Sulphate at 63° F.

Specific Gravity	Per cent $CuSO_4 + 5H_2O$	Specific Gravity	Per cent $CuSO_4 + 5H_2O$
1,0126	2	1,0933	14
1,0254	4	1,1063	16
1,0384	6	1,1208	18
1,0516	8	1,1354	20
1,0649	10	1,1501	22
1,0785	12	1,1659	24

Fehling's Solution is used in bleaching as a test for oxycellulose (compare page 130). It is prepared from solutions of sulphate of copper and Seignette salt.

Copper Sulphate Solution.	Seignette salt Solution.
69,278 g copper sulphate dissolved in water and made up to 1 litre	173 g Seignette salt dissolved in 400 cc water and made up to 500 cc. with 100 cc caustic soda (516 parts NaOH per 1000 parts).

Equal portions of both solutions are mixed before use.

In testing bleached cotton, for oxycellulose a sample is boiled with 10 % of the newly prepared solution on the water bath. A pink tint caused by precipitated cuprous oxide indicates the presence of oxycellulose.

Oxide of Antimony Sb_2O_3, mol. weight 287, is put upon the market as a white powder; it is dissolved in glycerine and caustic soda and is used as an addition to the β-Naphthol prepare, in order to prevent the naphtholed material from turning brown.

Potassium Antimony Tartrate or **Tartar Emetic** $K(SbO)C_4H_4O_6 + \frac{1}{2}H_2O$, mol. weight 332 (soluble in 15 parts of cold and 2 parts of hot water), is put upon the market in rhombic octahedra, and contains about 43 % oxide of antimony. The percentage is determined by titration with iodine.

It is used in dyeing with basic colours for fixing the tannin, with which it combines forming an insoluble lake. Although the fixing baths do not exhaust completely they must not be used for too long a time, because they get gradually saturated with tartar which removes the colour lake from the fibre. In fixing with tartar emetic or other antimony salts, it is necessary to add to the fixing bath some chalk or soda, in order to neutralize the liberated acid.

Specific Gravity of Solutions of Tartar Emetic at 63° F.

(Streit.)

Specific Gravity	Per cent Tartar Emetic	Specific Gravity	Per cent Tartar Emetic	Specific Gravity	Per cent Tartar Emetic
1,005	0,5	1,015	2,5	1,031	4,5
1,007	1,0	1,018	3,0	1,035	5,0
1,009	1,5	1,022	3,5	1,038	5,5
1,012	2,0	1,027	4,0	1,044	6,0

Sodium Tartar Emetic, $Na(SbO)\ C_4H_4O_6 + \frac{1}{2}H_2O$, mol. weight 316, is put upon the market in crystals, and is much more easily soluble than the corresponding potassium salt. It is therefore used for the preparation of concentrated Tartar emetic resists.

Potassium Antimony Oxalate, $K_3Sb(C_2O_4)_3 + 4H_2O$, serves as a substitute for tartar emetic. It contains only about 25 % Sb_2O_3, nevertheless, in fixing 10 parts of potassium antimony oxalate are equivalent to 10 parts tartar emetic, because this salt dissociates more easily, and the bath does not become as acid with continued use as when tartar emetic is employed.

Sodium Antimony Fluoride SbF_3NaF, is put upon the market in triclinic prisms, and is very soluble. It contains about 66 % Sb_2O_3; 6,6 parts of this salt are equivalent to 10 parts tartar emetic.

Antimony Salt, $SbF_3(NH_4)_2SO_4$, forms white, easily soluble crystals, and contains about 47 % Sb_2O_3. 9 parts of antimony salt are equivalent to 10 parts tartar emetic.

Lactate of Antimony or **Antimonine** is put upon the market as a yellowish moist substance; it contains only about 15% Sb_2O_3. In fixing, 10 parts antimonine can be substituted for 10 parts tartar emetic, as the baths exhaust completely. It is used with the addition of some acetic acid.

Stannous Chloride or **Tin crystals,** $SnCl_2 + 2H_2O$, mol. weight 225, is put upon the market in crystals. Being hygroscopic, it must be kept in well closed vessels. It dissolves well in little water, whereas an excess of water causes a hydrolytic separation, for which reason tin salt solutions must be acidified. Tin salt is used for the preparation of various tin mordants.

Specific Gravity of Solutions of Tin salt at 59° F.

(Gerlach.)

Specific Gravity	Per cent $SnCl_2 + 2H_2O$	Specific Gravity	Per cent $SnCl_2 + 2H_2O$	Specific Gravity	Per cent $SnCl_2 + 2H_2O$
1,013	2	1,212	28	1,497	54
1,026	4	1,230	30	1,525	56
1,040	6	1,249	32	1,554	58
1,054	8	1,268	34	1,582	60
1,068	10	1,288	36	1.613	62
1,083	12	1,309	38	1,644	64
1,097	14	1,330	40	1,677	66
1,113	16	1,352	42	1,711	68
1,128	18	1,374	44	1,745	70
1,144	20	1,397	46	1,783	72
1,161	22	1,421	48	1,821	74
1,177	24	1,445	50	1,840	75
1,194	26	1,471	52		

Acetate of Tin, $Sn(CH_3COO)_2$, mol. weight 236, is obtained either by dissolving stannous oxide in glacial acetic acid or by the double decomposition of tin salt and sugar of lead.

Acetate of Tin 32½° Tw.

1000 parts tin salt are dissolved hot with
800 parts acetic acid 9° Tw.

1000 parts sugar of lead are dissolved hot with
800 parts acetic acid 9° Tw.

The tin salt solution is mixed into the sugar of lead solution, left to cool, filtered, and diluted with acetic acid to 32½° Tw. Its chief use is as a discharge for direct dyeing colours.

Stannous Hydrate, $Sn(OH)_2$, mol. weight 152, is obtained by precipitating tin salt with soda.

Stannous Hydrate Paste 23%.

I. { 695 parts tin salt
10000 parts water

II. { 475 parts soda
10000 parts water.

II is slowly mixed into I whilst being stirred, then left to stand, decanted, filtered, and diluted to 2000 parts.

Oxalate of Tin $Sn(C_2O_4)_2$, mol. weight 294, is obtained by dissolving stannous hydrate in oxalic acid.

Oxalate of Tin 25° Tw.

1000 parts stannous hydrate paste 23% is heated on the water bath with 40 parts oxalic acid, and reduced with water to 25° Tw.

The hydrate must not dissolve completely. Oxalate of tin is used as auxiliary mordant for Alizarine Red Steam Colours.

* * *

20. VANADIUM AND CERIUM-SALTS.

Vanadate of Ammonia NH_4VO_3, mol. weight 172, is put upon the market as a yellowish white powder, it is used for the preparation of Vanadium Chloride, and as a carrier of oxygen.

Vanadium Chloride VCl_2, mol. weight 122, is used as a solution (1 : 1000) in printing with Aniline Oxidation Black. It can be prepared in the following manner:

10 g vanadate of ammonia are dissolved in 100 cc muriatic acid 34½° Tw, and 400 cc water; to this solution are added 5 g glycerine and heated until the yellowish green fluid has turned blue. The whole is diluted to 10 litres. The reduction is accelerated by adding Sodium bisulphite. For 10 g ammonium metavanadate 30 cc bisulphite 71½° Tw. are required.

Cerochloride $CeCl_3$, mol. weight 246, is put upon the market as a 20% solution, and is used as a carrier of oxygen in printing with Diphenyl Black.

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21. INORGANIC AND ORGANIC ACIDS.

Hydrochloric Acid, Muriatic Acid HCl, mol. weight 36, is put upon the market as a solution of 28½—38° Tw. The percentage can be found direct from the specific gravity or by titration. It is extensively used in bleaching etc. 97,3 cc, or 113,2 g hydrochloric acid 32½° Tw. contain 1 g mol. HCl.

Specific Gravity of Hydrochloric Acid.

(Lunge and Marchlewsky.)

Specific Gravity at 59° F / 39° F (vacuum)	Degrees Beaumé	Degrees Twaddle	100 parts by weight contain in chemically pure acid		1 litre contains kos	
			Per cent HCl	Acid 20° Bé	HCl	Acid 20° Bé
1,000	0,0	0,0	0,16	0,49	0,0016	0,0049
1,005	0,7	1	1,15	3,58	0,012	0,036
1,010	1,4	2	2,14	6,66	0,022	0,067
1,015	2,1	3	3,12	9,71	0,032	0,099
1,020	2,7	4	4,13	12,86	0,042	0,131
1,025	3,4	5	5,15	16,04	0,053	0,164
1,030	4,1	6	6,15	19,16	0,064	0,197
1,035	4,7	7	7,15	22,27	0,074	0,231
1,040	5,4	8	8,16	25,42	0,085	0,264
1,045	6,0	9	9,16	28,53	0,096	0,298
1,050	6,7	10	10,17	31,68	0,107	0,333
1,055	7,4	11	11,18	34,82	0,118	0,367
1,060	8,0	12	12,19	37,97	0,129	0,403
1,065	8,7	13	13,19	41,09	0,141	0,438
1,070	9,4	14	14,17	44,14	0,152	0,472
1,075	10,0	15	15,16	47,22	0,163	0,508
1,080	10,6	16	16,15	50,31	0,174	0,543
1,085	11,2	17	17,13	53,36	0,186	0,579
1,090	11,9	18	18,11	56,41	0,197	0,615
1,095	12,4	19	19,06	59,37	0,209	0,650
1,100	13,0	20	20,01	62,33	0,220	0,686
1,105	13,6	21	20,97	65,32	0,232	0,722
1,110	14,2	22	21,92	68,28	0,243	0,758
1,115	14,9	23	22,86	71,21	0,255	0,794
1,120	15,4	24	23,82	74,20	0,267	0,831
1,125	16,0	25	24,78	77,19	0,278	0,868
1,130	16,5	26	25,75	80,21	0,291	0,906
1,135	17,1	27	26,70	83,18	0,303	0,944
1,140	17,7	28	27,66	86,17	0,315	0,982
1,1425	18,0		28,14	87,66	0,322	1,002
1,145	18,3	29	28,61	89,13	0,328	1,021
1,150	18,8	30	29,57	92,11	0,340	1,059
1,152	19,0		29,95	93,30	0,345	1,075
1,155	19,3	31	30,55	95,17	0,353	1,099
1,160	19,8	32	31,52	98,19	0,366	1,139
1,163	20,0		32,10	100,00	0,373	1,163
1,165	20,3	33	32,49	101,21	0,379	1,179
1,170	20,9	34	33,46	104,24	0,392	1,220
1,171	21,0		33,65	104,82	0,394	1,227
1,175	21,4	35	34,42	107,22	0,404	1,260
1,180	22,0	36	35,39	110,24	0,418	1,301
1,185	22,5	37	36,31	113,11	0,430	1,340
1,190	23,0	38	37,23	115,98	0,443	1,380
1,195	23,5	39	38,16	118,87	0,456	1,421
1,200	24,0	40	39,11	121,84	0,469	1,462

Sulphuric Acid H_2SO_4, mol. weight 98, is put upon the market in highly concentrated form as acid of 66° Bé (168° Tw.) Concentrated sulphuric acid forms hydrates with water under generation of heat. Consequently, in diluting concentrated sulphuric acid it must be gradually mixed into an excess of cold water. The percentage of the acid is determined by titration with normal alkali. Sulphuric acid is largely used in bleaching and dyeing.

Specific Gravity of Sulphuric Acid.

(Lunge and Isler.)

Specific Gravity at $\frac{59^\circ F}{39^\circ F}$ (vacuum)	Degrees Beaumé	Degrees Twaddle	100 parts by weight contain in chemically pure acid	1 litre contains in chem. pure acid	Specific Gravity at $\frac{59^\circ F}{39^\circ F}$ (vacuum)	Degrees Beaumé	Degrees Twaddle	100 parts by weight contain in chemically pure acid	1 litre contains in chem. pure acid
			Per cent H_2SO_4	kos H_2SO_4				Per cent H_2SO_4	kos H_2SO_4
1,000	0	0	0,09	0,001	1,205	24,5	41	27,95	0,337
1,005	0,7	1	0,83	0,008	1,210	25,0	42	28,58	0,346
1,010	1,4	2	1,57	0,016	1,215	25,5	43	29,21	0,355
1,015	2,1	3	2,30	0,023	1,220	26,0	44	29,84	0,364
1,020	2,7	4	3,03	0,031	1,225	26,4	45	30,48	0,373
1,025	3,4	5	3,76	0,039	1,230	26,9	46	31,11	0,382
1,030	4,1	6	4,49	0,046	1,235	27,4	47	31,70	3,391
1,035	4,7	7	5,23	0,054	1,240	27,9	48	32,28	0,400
1.040	5,4	8	5,96	0,062	1,245	28,4	49	32,86	0,409
1,045	6,0	9	6,67	0,071	1,250	28.8	50	33,43	0,418
1,050	6,7	10	7,37	0,077	1,255	29,3	51	34,00	0,426
1,055	7,4	11	8,07	0,085	1,260	29,7	52	34,57	0,435
1.060	8,0	12	8,77	0.083	1,265	30,2	53	35,14	0,444
1,065	8,7	13	9,47	0,102	1,270	30,6	54	35,71	0.454
1,070	9,4	14	10,19	0,109	1,275	31,1	55	36,29	0.462
1,075	10,0	15	10,90	0,117	1,280	31,5	56	36,87	0,472
1,080	10,6	16	11,60	0,125	1.285	32,0	57	37,45	0,481
1,085	11,2	17	12,30	0,133	1,290	32,4	58	38,03	0.090
1,090	11,9	18	12,99	0,142	1,295	32,8	59	38,61	0,500
1,095	12.4	19	13,67	0,150	1,300	33,3	60	39,19	0,509
1,100	13,0	20	14,35	0,158	1,305	33,7	61	39,77	0,519
1,105	13.6	21	15,03	0,166	1,310	34.2	62	40,35	0,528
1,110	14,2	22	15,71	0,175	1,315	34,6	63	40,93	0,538
1,115	14,9	23	16,36	0,183	1,320	35,0	64	41,50	0,548
1,120	15,4	24	17,01	0,191	1,325	35,4	65	42,08	0.557
1,125	16,0	25	17,66	0,199	1,330	35,8	66	42,66	0,567
1,130	16,5	26	18,31	0,207	1,335	36,2	67	43,20	0,577
1,135	17,1	27	18,96	0,215	1,340	36,6	68	43,74	0,586
1,140	17,7	28	19,61	0,223	1,345	37,0	69	44,28	0,596
1,145	18,3	29	20.26	0,231	1,350	37,4	70	44,82	0,605
1,150	18,8	30	20,91	0,239	1,355	37,8	71	45,35	0,614
1,155	19,3	31	21,55	0,248	1,360	38,2	72	45,88	0,624
1,160	19,8	32	22,19	0,257	1,365	38,6	73	46,41	0.633
1,165	20,3	33	22,83	0,266	1,370	39,0	74	46,94	0,643
1,170	20,9	34	23,47	0,275	1,375	39,4	75	47,47	0,653
1,175	21,4	35	24,12	0,283	1,380	39,8	76	48,00	0,662
1,180	22,0	36	24,76	0,292	1,385	40,1	77	48,53	0,672
1,185	22,5	37	25,40	0,301	1,390	40,5	78	49,06	0,682
1,190	23,0	38	26,04	0,310	1.395	40,8	79	49,59	0,692
1,195	23,5	39	26,68	0,319	1,400	41,2	80	50,11	0,702
1,200	24,0	40	27,32	0,328	1,405	41,6	81	50,63	0,711

Specific Gravity at $\frac{59^\circ F}{39^\circ F}$ (vacuum)	Degrees Beaumé	Degrees Twaddle	100 parts by weight contain in chemically pure acid	1 litre contains in chem. pure acid	Specific Gravity at $\frac{59^\circ F}{39^\circ F}$ (vacuum)	Degrees Beaumé	Degrees Twaddle	100 parts by weight contain in chemically pure acid	1 litre contains in chem. pure acid
			Per cent H_2SO_4	kos H_2SO_4				Per cent H_2SO_4	kos H_2SO_4
1,410	42,0	82	51,15	0,721	1,675	58,2	135	74,97	1,256
1,415	42,3	83	51,66	0,730	1,680	58,4	136	75,42	1,267
1,420	42,7	84	52,15	0,740	1,685	58,7	137	75,86	1,278
1,425	43,1	85	52,63	0,750	1,690	58,9	138	76,30	1,289
1,430	43,4	86	53,11	0,759	1,695	59,2	139	76,73	1,301
1,435	43,8	87	53,59	0.769	1,700	59,5	140	77,17	1,312
1,440	44,1	88	54,07	0,779	1,705	59,7	141	77,60	1,323
1,445	44,4	89	54,55	0,789	1,710	60,0	142	78,04	1,334
1,450	44,8	90	55,03	0,798	1,715	60,2	143	78,48	1,346
1,455	45,1	91	55,50	0,808	1,720	60,4	144	78,92	1,357
1,460	45,4	92	55,97	0,817	1,725	60,6	145	79,36	1,369
1,465	45,8	93	56,43	0,827	1,730	60,9	146	79,80	1,381
1,470	46,1	94	56,90	0,837	1,735	61,1	147	80,24	1,392
1,475	46,4	95	57,37	0,846	1,740	61,4	448	80,68	1,404
1,480	46,8	96	57,83	0,856	1,745	61,6	149	81,12	1,416
1,485	47,1	97	58,28	0,865	1,750	61,8	150	81,56	1,427
1,490	47,4	98	58,74	0,876	1,755	62,1	151	82,00	1,439
1,495	47,8	99	59,22	0,885	1,760	62,3	152	82,44	1,451
1,500	48,1	100	59,70	0,896	1,765	62,5	153	82,88	1,463
1,505	48,4	101	60,18	0,906	1,770	62,8	154	83,32	1,475
1,510	48,7	102	60 65	0,916	1,775	63,0	155	83,90	1,489
1,515	49,0	103	61,12	0,926	1,780	63,2	156	84,50	1,504
1,520	49,4	104	61,59	0,936	1,785	63,5	157	85,10	1.519
1,525	49,7	105	62,06	0,946	1,790	63,7	158	85,70	1,534
1,530	50,0	106	62,53	0,957	1,795	64,0	159	86,30	1,549
1,535	50,3	107	63,00	0,967	1,800	64,2	160	86,90	1,564
1,540	50,6	108	63,43	0,977	1,805	64,4	161	87,60	1,581
1,545	50,9	109	63,85	0,987	1,810	64,6	162	88,30	1,598
1,550	51,2	110	64,26	0,996	1,815	64,8	163	89,05	1,621
1,555	51,5	111	64,67	1,006	1,820	65,0	164	90,05	1,639
1,560	51,8	112	65,08	1,015	1,821			90,20	1,643
1,565	52,1	113	65,49	1,025	1,822	65,1		90,40	1,647
1,570	52,4	114	65,90	1,035	1,823			90,60	1,651
1,575	52,7	115	66,30	1,044	1,824	65,2		90,80	1,656
1,580	53,0	116	66,71	1,054	1,825		165	91,00	1,661
1,585	53,3	117	67,13	1,064	1,826	65,3		91,25	1,666
1.590	53 6	118	67,59	1,075	1,827			91,50	1,671
1,595	53,9	119	68,05	1,085	1,828	65,4		91,70	1,676
1,600	54,1	120	68,51	1,096	1,829			91,90	1,681
1,605	54,4	121	68,97	1,107	1,830		166	92,10	1,685
1,610	54,7	122	69,43	1,118	1,831	65,5		92,30	1,690
1,615	55,0	123	69,89	1,128	1,832			92,52	1,695
1,620	55,2	124	70,32	1,139	1,833	65,6		92,75	1,700
1,625	55,5	125	70,74	1,150	1,834			93,05	1,706
1,630	55,8	126	71,16	1,160	1,835	65,7	167	93,43	1,713
1,635	56,0	127	71,57	1,170	1,836			93,80	1,722
1,640	56,3	128	71,99	1,181	1,837			94,20	1,730
1,645	56,6	129	72,40	1,192	1,838	65,8		94,60	1,739
1,650	56,9	130	72,82	1,202	1,839			95,00	1,748
1,655	57,1	131	73,23	1,212	1,840	65,9	168	95,60	1,759
1,660	57,4	132	73,64	1,222	1,8405			95,95	1,765
1,665	57,7	133	74,07	1,233	1,8410			97,00	1,786
1,670	57,9	134	74,51	1,244	1,8415			97,70	1,799

Nitric Acid HNO_3, mol. weight 63, is put upon the market as a liquid of 66½°—76½° Tw. which dissolves most metals, converting them into nitrates.

Specific Gravity of Nitric Acid.

(Lunge and Rey.)

Specific Gravity	Degrees Twaddle	100 parts contain at 59° F		Specific Gravity	Degrees Twaddle	100 parts contain at 59° F	
		grs HNO_3	grs N_2O_5			grs HNO_3	grs N_2O_5
1,000	0	0,1	0,1	1,265	53	42,1	36,1
1,005	1	1,0	0,8	1,270	54	42,9	36,7
1,010	2	1,9	1,6	1,275	55	43,6	37,4
1,015	3	2,8	2,4	1,280	56	44,1	38,1
1,020	4	3,7	3,2	1,285	57	45,2	38,7
1,025	5	4,6	3,9	1,290	58	45,9	39,4
1,030	6	5,5	4,7	1,295	59	46,7	40,0
1,035	7	6,4	5,5	1,300	60	47,5	40,7
1,040	8	7,3	6,2	1,305	61	48,3	41,4
1,045	9	8,1	7,0	1,310	62	49,1	42,1
1,050	10	9,0	7,7	1,315	63	49,9	42,8
1,055	11	9,8	8,4	1,320	64	50,7	43,5
1,060	12	10,7	9,1	1,325	65	51,5	44,2
1,065	13	11,5	9,9	1,330	66	52,4	44,9
1,070	14	12,3	10,6	1,335	67	53,2	45,6
1,075	15	13,1	11,3	1,340	68	54,1	46,3
1,080	16	13,9	12,0	1,345	69	54,9	47,1
1,085	17	14,7	12,6	1,350	70	55,8	47,8
1,090	18	15,5	13,3	1,355	71	56,7	48,6
1,095	19	16,3	14,0	1,360	72	57 6	49,3
1,100	20	17,1	14,7	1,365	73	58,5	50,1
1,105	21	17,9	15,3	1,370	74	59,4	50,9
1,110	22	18,7	16,0	1,375	75	60,3	51,7
1,115	23	19,4	16,7	1,380	76	61,3	52,5
1,120	24	20,2	17,3	1,385	77	62,2	53,1
1,125	25	21,0	18,0	1,390	78	63,2	54,2
1,130	26	21,8	18,7	1,395	79	64,2	55,1
1,135	27	22,5	19,3	1,400	80	65,3	56,0
1,140	28	23,3	20,0	1,405	81	66,4	56,9
1,145	29	24,1	20,6	1,410	82	67,5	57,9
1,150	30	24,8	21,3	1,415	83	68,6	58,8
1,155	31	25,6	21,9	1,420	84	69,8	59,8
1,160	32	26,4	22,6	1,425	85	71,0	60,8
1,165	33	27,1	23,2	1,430	86	72,2	61,9
1,170	34	27,9	23,9	1,435	87	73,4	62,9
1,175	35	28,6	24,5	1,440	88	74,7	64,0
1,180	36	29,4	25,2	1,445	89	76,0	65,1
1,185	37	30,1	25,8	1,450	90	77,3	66,2
1,190	38	30,9	26,5	1,455	91	78,6	67,4
1,195	39	31,6	27,1	1,460	92	80,0	68,6
1,200	40	32,4	27,7	1,465	93	81,4	69,8
1,205	41	33,1	28,4	1,470	94	82,9	71,1
1,210	42	33,8	29,0	1,475	95	84,4	72,4
1,215	43	34,5	29,6	1,480	96	86,0	73,8
1,220	44	35,3	30,2	1,485	97	87,7	75,2
1,225	45	36,0	30,9	1,490	98	89,6	76,8
1,230	46	36,8	31,5	1,495	99	91,6	78,5
1,235	47	37,5	32,2	1,500	100	94,1	80,6
1,240	48	38,3	32,8	1,505	101	96,4	82,6
1,245	49	39,0	33,5	1,510	102	98,1	84,1
1,250	50	39,8	34,1	1,515	103	99,1	84,9
1,255	51	40,6	34,8	1,520	104	99,7	85,4
1,260	52	41,3	35,4				

Formic Acid HCOOH, mol. weight 46, has partly replaced acetic acid owing to its lower price. It has a pungent smell, is put upon the market as a liquid of 80—96 %, and is used for the preparation of various mordants. Formic acid is more volatile than acetic acid, and is one of the strongest organic acids.

Specific Gravity of Formic Acid at 68° F, compared with water at 39° F.

(Richardson and Allaire.)

Specific Gravity	Weight Per cent CH_2O_2	Volume Per cent CH_2O_2	Specific Gravity	Weight Per cent CH_2O_2	Volume Per cent CH_2O_2	Specific Gravity	Weight Per cent CH_2O_2	Volume Per cent CH_2O_2
0,9983	0	0,00	1,0247	10	8,40	1,1425	60	56.13
1,0020	1	0,82	1,0371	15	12,80	1,1544	65	61,44
1,0045	2	1,64	1,0489	20	17,17	1,1656	70	66,80
1,0071	3	2,48	1,0610	25	21,73	1,1770	75	72.27
1,0094	4	3,30	1,0730	30	26,37	1,1861	80	77,67
1,0116	5	4,14	1,0848	35	31,10	1,1954	85	83,19
1,0142	6	4,98	1,0964	40	35,90	1,2045	90	88,74
1,0171	7	5,81	1,1086	45	40,82	1,2141	95	94,48
1,0197	8	6,68	1,1208	50	45,88	1,2213	100	100,00
1,0222	9	7,55	1,1321	55	51,01			

Acetic Acid CH_3COOH, mol. weight 60, is put upon the market as Glacial Acetic Acid of 100 %, or in solutions of 9—12 or more degrees of Tw. It it impossible to determine the exact percentage by specific gravity, and therefore it is advisable to ascertain it by titration with normal alkali. Acetic acid is used as a solvent of dyestuffs, for preventing lake formation in printing colours, for correcting water etc.

Specific Gravity of Acetic Acid at 59° F.

(Oudemans.)

Specific Gravity	Per cent	Specific Gravity	Per cent	Specific Gravity	Per cent	Specific Gravity	Per cent
0,9992	0	1,0363	26	1,0631	52	1,0748	78
1,0007	1	1,0375	27	1,0638	53	1,0748	79
1,0022	2	1,0388	28	1,0646	54	1,0748	80
1,0037	3	1,0400	29	1,0653	55	1,0747	81
1,0052	4	1,0412	30	1,0660	56	1,0746	82
1,0067	5	1,0424	31	1,0666	57	1,0744	83
1,0083	6	1,0436	32	1,0673	58	1,0742	84
1,0098	7	1,0447	33	1,0679	59	1,0739	85
1,0113	8	1,0459	34	1,0685	60	1,0736	86
1,0127	9	1,0470	35	1,0691	61	1,0731	87
1,0142	10	1,0481	36	1,0697	62	1,0726	88
1,0157	11	1,0492	37	1,0702	63	1,0720	89
1,0171	12	1,0502	38	1,0707	64	1,0713	90
1,0185	13	1,0513	39	1,0712	65	1,0705	91
1,0200	14	1,0523	40	1,0717	66	1,0696	92
1,0214	15	1,0533	41	1,0721	67	1,0686	93
1,0228	16	1,0543	42	1,0725	68	1,0674	94
1,0242	17	1,0552	43	1,0729	69	1,0660	95
1,0256	18	1,0562	44	1,0733	70	1,0644	96
1,0270	19	1,0571	45	1,0737	71	1,0625	97
1,0284	20	1,0580	46	1,0740	72	1,0604	98
1,0298	21	1,0589	47	1.0742	73	1,0580	99
1,0311	22	1,0598	48	1,0744	74	1,0553	100
1,0324	23	1,0607	49	1,0746	75		
1,0337	24	1,0615	50	1,0747	76		
1,0350	25	1,0623	51	1,0748	77		

Note: The specific gravities above 1,0553 indicate two solutions of different strength. In order to ascertain whether an acid is being dealt with, whose percentage of acetic acid exceeds the maximum of density (78%), it is only necessary to add some water. If the specific gravity increases, the acid was stronger than 78%, if it decreases, it was weaker.

Oxalic Acid $C_2O_4H_2+2H_2O$, mol. weight 126, is put upon the market in white monoclinic crystals. It impairs the fibre in steaming. Oxalic acid is used for the preparation of oxalate of tin, oxalate of lime etc.

Tartaric Acid $C_4O_6H_6$, mol. weight 150, crystallizes in large white prisms, and is used in dyeing and printing as a solvent, which prevents lake formation.

Ethyl Tartaric Acid $C_4H_5O_6 \cdot C_2H_5$, is put upon the market as a solution of 22° Tw., and is used as an addition to basic printing colours, instead of Tartaric acid, or acetine. It decomposes in steaming under regeneration of alcohol, and therefore does not impair the fibre as much as Tartaric acid.

Lactic Acid $CH_3CH(OH)COOH$, mol. weight 90, is put upon the market as a solution of 50%. It injures the cotton fibre very little and is used, f. e., for dissolving the base in printing with Diphenyl Black.

Tannin or **Tannic Acid** $C_{14}H_{10}O_9 + 2H_2O$, mol. weight 358, is brought upon the market in the form of needles, or as a pale yellow to brown powder. Tannin is tested either by titration with permanganate of potassium in presence of Indigo solution, or by sample dyeing, in which case the light shades of Magenta and Methylene Blue Tannin Lakes are specially adapted for determining the fixing strength and purity of the tannin. Tannin is chiefly used as a mordant for basic dyestuffs.

Specific Gravity of Solutions of Tannin at 59° F.
(Trammer.)

Specific Gravity	Per cent	Specific Gravity	Per cent	Specific Gravity	Per cent	Specific Gravity	Per cent
1,0040	1,0	1,0092	2,3	1,0144	3,6	1,0196	4,9
1,0044	1,1	1,0096	2,4	1,0148	3,7	1,0200	5,0
1,0048	1,2	1,0100	2,5	1,0152	3,8	1,0242	6
1,0052	1,3	1,0104	2,6	1,0156	3,9	1,0324	8
1,0056	1,4	1,0108	2,7	1,0160	4,0	1,0406	10
1,0060	1,5	1,0112	2,8	1,0164	4,1	1,0489	12
1,0064	1,6	1,0116	2,9	1,0168	4,2	1,0572	14
1,0068	1,7	1,0120	3,0	1,0172	4,3	1,0656	16
1,0072	1,8	1,0124	3,1	1,0176	4,4	1,0740	18
1,0076	1,9	1,0128	3,2	1,0180	4,5	1,0824	20
1,0080	2,0	1,0132	3,3	1,0184	4,6		
1,0084	2,1	1,0136	3,4	1,0188	4,7		
1,0088	2,2	1,0140	3,5	1,0192	4,8		

Besides Tannin are used:

Sumac and Sumac Extract,
Gall Nuts,
Myrabolams.

The percentage of tannic acid in these products varies. On an average 1 lb. tannin is equivalent to

4 lbs sumac leaves,
2 lbs sumac extract 67° Tw,
1,4 lbs gall nuts,
3 lbs myrabolams.

22. OILS AND SOAPS.

Olive Oil, specific gravity 0,914 to 0,917, is added to printing colours, in order to make them work smoothly.

Castor Oil. specific gravity 0,960 to 0,964, is used for the preparation of Turkey red oil and chlorine oil.

Softening. Under this name preparations are put upon the market which are emulsions of oil in soap, often mixed with glycerine, silicate, or even starch. There are sodium and potassium softenings on the market. The former are less effective than the latter, but they have this advantage that they prevent the added oil from becoming rancid. The softenings are obtained by mixing a warm alkali solution with an excess of oil, so that a neutral soap plus oil results. The mixture is then boiled whilst being stirred. Another process is, to add oil to a warm soap solution and to heat the mixture to boiling point. The second method permits of combining two different fats, such as olive oil with palm oil soap.

Olive oil is suitable for soda softenings, tallow; as free fat for potash softenings. Three parts dry soap are mixed with 1 part oil and 7 parts water.

Monopole Soap is a soap put upon the market by Stockhausen & Traiser of Crefeld. Its solutions have a weak acid reaction, and its lime salts and magnesium salts are soluble in an excess of the monopole soap. It is therefore advantageously employed with hard water.

Chlorine oil is obtained by mixing castor oil with chloride of lime solution. If added to the Alizarine Red printing colours, a more brilliant red is produced. Chlorine oil is prepared in the following manner:

1 part castor oil and
1 part chloride of lime solution 3° Tw are well mixed.

Para Soap PN is obtained by partial neutralization of ricinoleic acid acid with ammonia. It is extensively used as assistant to the naphthol prepares in dyeing and printing with Paranitraniline, on account of its particularly favourable effect upon the shade.

Turkey Red Oils are sulphurated castor oils which are largely used in dyeing, printing and bleaching vegetable substances. There are soda and ammonia Turkey red oils. The former, discovered and first introduced into practice in 1877 by Dr. A. Wuth at Ramsbottom, the latter, discovered by Fritz Stork, effected a great revolution in dyeing, especially in Turkey red dyeing.

Turkey red oils, a description of which has been given in the first volume of this work, page 197, are put on the market under various names.

Turkey Red Oil Analysis.

Primary Test. The oil must react slightly alkaline or neutral. Mixed with water a perfect emulsion must be obtained from which oil drops are separated after standing for some time. These oil drops must be perfectly soluble in ammonia, otherwise unsaponified fat is present.

Water. According to Stein 10 g oil are melted with 25 g dry wax in about 75 cc saturated salt solution. The cake is dried and weighed. The increased weight of wax represents oil free from water; the difference between 10 or the amount of oil used is water.

Total Fat. 100 cc of the oil to be analysed are mixed in a narrow graduated cylinder with 20 cc hydrochloric acid conc., and then made up with saturated salt solution to 500 cc. The whole is heated whilst being frequently shaken. On cooling the fat swims on the salt solution. The number of cc indicates the sum total of fat sufficiently accurately for practical purposes.

It is also advisable, to test the soaps from time to time.

Soap Analysis.

Water. A certain quantity of soap, say 3 g is mixed with about 10 g perfectly dry quartz sand in a porcelain dish, and the whole weighed. After adding a little alcohol, to accelerate the evaporation of the remaining water, the mixture is dried until a constant weight is obtained. The loss indicated by the difference in weight represents water.

Fatty Acid. The following method is sufficient for all practical purposes: A quantity of soap, say 3 g, accurately weighed, is dissolved with water in a porcelain dish. The fatty acid is then precipitated with an excess of normal sulphuric acid, and melted with 10 g pure and perfectly dry wax. The wax cake which easily separates on cooling, is rinsed in cold water, and then dried first with filter paper and then in the exsiccator until a constant weight is obtained.

Total Alkali. The filtrate obtained by the fatty acid test is neutralized with normal soda lye and Phenolphtaleine. The number of cc soda lye used, deducted from the number of cc normal sulphuric acid shows the sum total of alkali, 1 cc normal sulphuric acid being equivalent with 0,031 g Na_2O.

Another method is to titrate 100 cc soap solution containing 2—3 g soap direct with normal acid and Methyl Orange until a red tinge appears: 1 cc normal acid is equal to 0,031 g Na_2O.

Free Alkali. Qualitative Test. If a freshly cut surface of the soap is touched with a few drops of mercury chloride solution a brownish yellow to reddish brown colour will appear, according to the amount of free alkali.

Glycerine. 20—25 g soap are dissolved in 100 cc water, then the fatty acid precipitated with sulphuric acid till acid reaction sets in, and removed with wax. The filtrate is neutralized with potash, evaporated till dry, powdered and extracted with pure alcohol. The extracted solution is filtered into a glass of known tare and heated on a water bath or, better still, to 122^0—140^0 F, until constant weight is obtained. The residue is glycerine.

Unsaponified Fat. Very finely powdered and dried soap, about 20—25 g, are extracted with ligroine in the Soxhlet's extraction apparatus for 3—4 hours, the ligroine evaporated and the fat weighed. Traces of soap being soluble in ligroine, a portion of the soap separated in the flask must be poured off, rinsed and the corresponding correction be made: 100 cc ligroine dissolve 0,01 g olive oil soap.

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23. SOLVENTS.

Methyl Alcohol CH_3OH, mol. weight 32, and **Ethyl Alcohol** C_2H_5OH, mol. weight 46, are used as solvents for basic dyestuffs. The specific gravity is ascertained by means of the areometer.

Glycerine $C_3H_5(OH)_3$, mol. weight 92, is a colourless viscous fluid of sweet taste. It is very hygroscopic. Glycerine is used, in finishing, as a solvent, and as a hygroscopic addition to printing colours. Also, in cotton dyeing, when using mechanical apparatus of the packing system, in order to facilitate the wetting and to make the material soft and supple.

Benzine is a liquid of light weight, its specific gravity being 0,65—0,75, and is used as an addition to printing colours which froth easily.

Turpentine, a colourless liquid of peculiar smell, specific gravity 0,68—0,89, is, like benzine, added to colours in order to prevent them from frothing, also for removing oil stains.

Solution Ether is Diaethylamine of high percentage, boils at 136° F. It is a colourless liquid of ammonia-like smell and basic properties, an excellent solvent for mordant colours.

Formaldehyde HCHO, mol. weight 30, is a volatile compound, easily soluble in water, of pungent smell and has great affinity to bisulphites, hydrosulphites, albuminous and gluey substances. Polymerisation forms little soluble or insoluble substances. Formaldehyde is put upon the market as a solution of 40%, and is used for the preparation of stable hydrosulphite compounds.

Carbolic Acid or **Phenol** C_6H_5OH, mol. weight 94, forms, in its pure state, a white crystalline substance, little soluble in water. It is poisonous and cauterizes the skin. It is used in finishes as an antiseptic, and furthermore as an addition to coloured discharges produced with Hydrosulphite NF conc., because it prevents the lake formation of Tannin Colours without destroying the hydrosulphite.

Acetine is formed by heating glycerine with Glacial acetic acid, and represents a mixture of Mono-, Di- and Tri-Acetine with free acetic acid. In steaming it separates again into acetic acid and glycerine. It is an effective solvent for basic colours which dissolve with difficulty (Indulines etc.).

Malt contains the ferment called Diastase, which is capable of converting starch into dextrine or sugar. Malt decoctions are used for removing starchy thickenings, sizings etc., from printed and steamed goods. As diastase loses its efficiency at a higher temperature than 140 ° F, the malt baths may only be used tepid.

Diastaphor. Under this name--there have recently been put upon the market some highly concentrated, soluble preparations of diastase, which may eventually replace malt.

24. FINISHES AND THICKENINGS.

Glue is a nitrogenous animal substance, prepared from bones, skin- or leather-clippings, and is put upon the market either in yellowish brown tablets or as a gelatinous paste. In solution it is added to dyebaths, in order to prevent colours from running into the white. It is also used as an addition to finishes and thickenings. In a purified, colourless and easily soluble form it is chiefly employed, as **Gelatine,** for finishing. When dissolved in water it hardens on cooling. An addition of acetic acid keeps it in a liquid state. Glue solutions easily become putrid. It is therefore advisable to add to them antiseptic substances, such as phenol, salicylic acid, boric acid etc.

Starch is a carbon hydrate insoluble in cold water. On being heated with water, starch begins to swell at about 140 ° F and as so-called starch paste forms an excellent thickening. In order to prevent the putrefaction of starch paste, small quantities of antiseptic substances, e. g. salicylic acid or boric acid are added. The different kinds of starch are distinguished by the aid of the microscope. Starch reacts with iodine which serves as a sure means of recognition. Strong heat and acids convert starch into dextrine, and under suitable conditions it is converted into sugar by acids and certain ferments.

The following are the most important kinds of starch:

Wheat Starch must not contain more than 15 % water, nor leave more than 0,5 % ash. The starch is stirred in water and gradually heated whilst continually stirred. It swells and thickens till at a certain moment it begins to thin again. From that moment it must be allowed to cool. This thickening, acidified with acetic acid, is used for printing with basic dyestuffs in deep shades. Besides the water and combustion test starch should be tested for stability. The starch paste, after standing for some days, is tested with litmus. The longer it keeps without becoming acid, the better is its quality. Starch can also be made into a paste cold by means of strong caustic soda. It is made into a paste with some water and then added to the soda. The starch swells and becomes transparent, forming the so-called apparatine which is used for finishes (the caustic soda has to be neutralized before use).

Rice Starch is little used for thickening, as the paste made from it easily absorbs water. It is, however, used in finishing.

Maize Starch very often takes the place of wheat starch for thickenings and finishes.

Potato Starch is most extensively used in finishing. It contains up to 20 % water.

Wheat flour contains a nitrogenous substance, the so-called gluten. A good quality must not contain more than 16 % water nor leave more then 4 % ash.

Burnt Starch is obtained by roasting wheat starch, and is put upon the market as lighter or darker coloured powders according to the degree of roasting. The lighter kinds are more advantageous as a thickening. Well burnt starch contains less than 5 % water. In order to test burnt starch for its amount of unchanged starch, a certain quantity is put on a filter of known weight, and washed out with cold water. The residue is dried and weighed, the result showing the amount of unchanged starch.

British Gum is obtained by roasting maize starch. In order to prepare the thickening, British gum is mixed with water, continually stirred while being heated till completely dissolved, and then cooled. The thickening contains 30—50 % British gum. Like burnt starch, it is put on the market as lighter or darker coloured powders. The former are less roasted and contain larger quantities of unchanged starch.

Dextrine is obtained from potato flour, and is put upon the market as a white or as a yellow product. It is used for thickenings and finishes.

Leiogomme is likewise obtained by roasting potato flour, and forms a pale yellow powder which is chiefly used for finishing.

Glucose or **Grape Sugar** is put upon the market in yellowish lumps, it is hygroscopic, and is, therefore, used in finishing, to maintain a certain degree of moisture in the goods. It is also used in dyeing with certain blue Thiogene Colours.

The following products are chiefly used in printing, less frequently in dyeing and finishing:

Tragacanth, a dried vegetable sap, is put upon the market in shell-like or leafy pieces. It forms the best thickening ingredient (with 60 g per litre a good thickening is obtained). It is used by itself or also in combination with wheat starch and wheat flour. Tragacanth is mixed with water and left to swell for 24 hours, whereupon it is heated for some time, if possible under pressure , till completely dissolved. The commercial kinds of tragacanth differ largely, wherefor it is necessary, before purchasing, to make a thickening test against a known sort.

Carragheen or **Iceland Moss,** is a species of algae which produces a mucilaginous substance, and is used for finishing, sizing or as a thickening in yarn printing. Hot water is poured over the carragheen moss, which is then left to stand for 12 hours, after which more water is added, the whole boiled and finally strained through a cloth. On cooling the liquid thickens to a gelatine.

Gums. Of these Senegal gum or gum Arabic are mostly used. A good quality should be easily soluble in water, contain few insoluble parts, give a light coloured solution, and should not coagulate with mordants when allowed to stand. Senegal gum thickening is prepared by mixing it with water and heating it until completely dissolved. Some natural gums have to be softened under pressure or with acids in order to be dissolved. Other sorts are easily soluble and may be added direct to the printing colours in form of powder. For certain colours and discharges the cheaper artificial commercial gum, crystal gum etc. can be employed. Colours which are thickened with gum turn out lighter in shade than those thickened with starch.

Albuminous substances are mechanically acting fixing media, and are used in printing with mineral- and lake colours. Egg albumen forms transparent amber coloured tablets, and is used for delicate shades. Good egg albumen must be soluble in water without sediment. Blood albumen, though a better fixing medium, is cheaper than egg albumen, but far less pure; consequently it can only be used for dark shades. For light shades decolorised blood albumen must be used. In order to dissolve albumen, it is best to mix it with water of about 77° F. It gradually falls to the bottom, swells and dissolves. A perfect solution is obtained in 24 hours. The darker kinds of albumen possess great thickening and sticking properties. In order to bleach them, their solutions are treated with turpentine, by whose ozonising action the bleaching is effected.

Caseine is little used in printing, because the colours fixed with albumen turn out faster. It is mostly dissolved by the addition of borax.

Formaldehyde in solution or also as gas, has a strongly coagulating effect upon albumen and caseine, of which reaction, use is now and then made in fixing pigment colours.

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25. WATER IN BLEACHING AND DYEING.

Water is of paramount importance in bleaching and dyeing. Unprofitable working and losses generally (too great a consumption of drugs and dyestuffs) are often accounted for by the water supply being inadequate in quality and quantity.

Natural water is seldom pure and it is therefore mostly necessary to purify or correct it. Besides mechanical impurities water contains salts which, — if present in considerable quantity, — must be removed before use.

Mechanical impurities, such as are carried along by rivers and brooks after rain, are most conveniently retained by means of weirs.

Salts — principally those of lime and magnesia — must be precipitated, if present in large quantities, by chemical means in apparatus specially constructed for the purpose. In most cases soda is used for the precipitation. Small quantities may be boiled with soda in wooden cisterns. To every 100 litres of water 2 grs. calc. soda are added for each degree of hardness, and the precipitate (lime) is allowed to settle.

Whether a chemical purification is practical or necessary, depends on the use to which the water is put in each special case; water of more than 15—20° of hardness should be purified, particularly when intended to be used for machine dyeing.

A small excess of soda in the water does no harm in dyeing with Dianil and Thiogene Colours, it should, however, be corrected with acetic acid when working with basic colours, aftertreating dyed shades with metal salts etc.

Water containing iron is totally unsuitable for bleaching and dyeing and its purification is absolutely necessary. Apparatus for this operation are supplied by the firm of Büttner & Meyer of Uerdingen o/Rhine.

Water containing lime and magnesia salts is called hard water. The degree of hardness varies in different countries, (as is shown in the table on page 320). One has further to distinguish between the constant degree of hardness and the transitory hardness of water. Water containing bicarbonate of lime loses in boiling half of its carbonic acid, and insoluble carbonate of lime is precipitated. Transitory hardness is, therefore, caused by the presence of soluble bicarbonate of lime in the water.

Constant hardness of water is caused by sulphates, especially sulphate of lime. These do not decompose on boiling and, consequently, do not precipitate.

The sum total of transitory and constant hardness is called the total degree of hardness.

Testing Water for its Degree of Hardness.

Total Degree of Hardness. 100 cc water are filled into a glass-stoppered cylinder of about 200 cc capacity. To this some normal soap solution is gradually added until the froth, formed when shaking the cylinder, remains standing above the liquid for 5 minutes. If the water shows more than 12° hardness, 10 cc of the liquid are diluted to 100 cc distilled water, and then tested as described above. The consumed number of cc of soap solution indicates, according to the table below, the total degree of hardness of the water.

Constant Degree of Hardness. 500 cc of the sample to be tested are boiled for 15 minutes. If any salts are precipitated in boiling, the same are filtered, and the solution filled up again to 500 cc with distilled water. Of this liquid 100 cc are poured into a glass-stoppered cylinder, and the test then carried out as described above.

German degrees of hardness indicate milligrammes of CaO in 100 grs water; French degrees of hardness refer to milligrammes of $CaCO_3$ in 100 grs water; English degrees of hardness indicate grains of $CaCO_3$ in 1 gallon water.

Table for determining the Hardness of Water.

cc Soap	German Degrees of Hardness	cc Soap	German Degrees of Hardness	cc Soap	German Degrees of Hardness	cc Soap	German Degrees of Hardness
3,4	0,5	15,9	3,7	26,2	6,5	37,4	9,7
4,2	0,7	16,6	3,9	26,9	6,7	38,1	9,9
5,0	0,9	17,0	4,0	27.6	6,9	38,4	10,0
5,4	1,0	17,4	4,1	28,0	7,0	38,7	10,1
5,8	1,1	17,8	4,2	28,4	7,1	39,4	10,3
6,6	1,3	18,1	4,3	29,1	7,3	40,1	10,5
7,4	1,5	18,5	4,4	29,8	7,5	40.8	10,7
8,2	1,7	18,9	4,5	30,0	7,7	41.5	10,9
9,0	1,9	19,7	4,7	31,2	7,9	41,8	11,0
9,4	2,0	20,4	4,9	31,6	8,0	41,9	11,1
9,8	2,1	20,8	5,0	31,9	8,1	42,4	11,2
10,5	2,3	21,2	5,1	32,6	8,3	42,8	11,3
11,3	2,5	21,9	5,3	33,3	8,5	43,1	11,4
12.1	2,7	22,6	5,5	34,0	8,7	43,4	11,5
12,8	2,9	23,3	5,7	34.7	8,9	43,7	11,6
13,2	3,0	24,0	5,9	35,0	9,0	44,0	11 7
13,6	3,1	24,4	6,0	35,3	9,1	44,4	11.8
14,3	3,3	24,8	6,1	36,0	9,3	44,7	11,9
15,1	3,5	25,5	6,3	36,7	9,5	45,0	12,0

Comparative Table of German, English and French Degrees of Hardness.

German	English	French	German	English	French	German	English	French
0,5	0,62	0,9	3,92	4,9	7,0	8,5	10,63	15,18
0,56	0,7	1,0	4,0	5,0	7,17	8,8	11,0	15,75
0.7	0,87	1,26	4,48	5,60	8,00	8,96	11,20	16,00
0,8	1,0	1,43	4,5	5,63	8,06	9.0	11,25	16,08
1,0	1,25	1,79	4,8	6,00	8,60	9,5	11,88	17,0
1,12	1,41	2,0	5,0	6,25	8,95	10,0	12,50	17,9
1,5	1,88	2,69	5,04	6,30	9,00	10,08	12,6	18,0
1,68	2,10	3,0	5,5	6,88	9,85	10,4	13,0	18,6
2,0	2,5	3,58	5,6	7,00	10,00	10,5	13,13	18,78
2,24	2,8	4,0	6,0	7,5	10,74	10,64	13,3	19,0
2,4	3,0	4,3	6,5	8,13	11,64	11,0	13,75	19,68
2,5	3,13	4,48	6,7	8,38	12,00	11,2	14,00	20,0
2,8	3,5	5,0	7,0	8,75	12,55	11,5	14,38	20,59
3,0	3,75	5,37	7,28	9,10	13,43	11,76	14,07	21.0
3.2	4,0	5,73	7,84	9,8	14,00	12,0	15,0	21,5
3,36	4,2	6,0	8,0	10,0	14,30			
3,5	4,38	6,27	8,4	10,5	15,0			

Table for determining the Quantity of Acetic Acid required to correct the Water.

To 1 litre water a trace of Methyl Orange is added, and normal hydrochloric acid 1 : 10 (10 cc hydrochloric acid 34½° Tw. per litre) poured into it until a change of colour is noticeable. The table shows what quantity of acetic acid of different strength is required for correcting 100 litres water, the first column referring to normal hydrochloric acid 1 : 10 used.

Normal Hydrochloric Acid 1: 10 cc per litre Water	Grammes of Acetic Acid necessary to correct 100 litres Water						
	12° Tw.	10½° Tw.	9° Tw.	7½° Tw.	6° Tw.	4½° Tw.	3° Tw.
1	1,3	1,5	2	2,4	3	3,5	6
2	2,6	3	4	4,8	6	7	12
3	3,9	4,5	6	7,2	9	10,5	18
4	5,2	6	8	9,6	12	14	24
5	6,5	7,5	10	12	15	17.5	30
6	7,8	9	12	14,4	18	21	36
7	9.1	10,5	14	16,8	21	24,5	42
8	10,4	12	16	19,2	24	28	48
9	11,7	13,5	18	21,6	27	31,5	54
10	13	15	20	24	30	35	60
11	14,3	16,5	22	26,4	33	38,5	66
12	15.6	18	24	28,8	36	42	72
13	16,9	19,5	26	31,2	39	45,5	78
14	18,2	21	28	33,6	42	49	84

Normal Hydrochloric Acid 1:10 cc per litre Water	Grammes of Acetic Acid necessary to correct 100 litres Water						
	12° Tw.	10¹/₂° Tw.	9° Tw.	7¹/₂° Tw.	6° Tw.	4¹/₂° Tw.	3° Tw.
15	19,5	22,5	30	36	45	52,5	90
16	20,8	24	32	38,4	48	56	96
17	22,1	25,5	34	40,8	51	59,5	102
18	23,4	27	36	43,2	54	63	108
19	24,7	28,5	38	45,6	57	66,5	114
20	26	30	40	48	60	70	120
21	27,3	31,5	42	50,4	63	73,5	126
22	28,6	33	44	52,8	66	77	132
23	29,9	34,5	46	55,2	69	80,5	138
24	31,2	36	48	57,6	72	84	144
25	32,5	37,5	50	60	75	87,5	150
26	33,8	39	52	62,4	78	91	156
27	35,1	40,5	54	64,8	81	94,5	162
28	36,4	42	56	67,2	84	98	168
29	37,7	43,5	58	69.6	87	101,5	174
30	39	45	60	72	90	105	180
31	40,3	46,5	62	74,4	93	108,5	186
32	41,6	48	64	76,8	96	112	192
33	42,9	49,5	66	79,2	99	115,5	198
34	44,2	51	68	81,6	102	119	204
35	45,5	52,5	70	84	105	122,5	210
36	46,8	54	72	86,4	108	126	216
37	48,1	55,5	74	88,8	111	129,5	222
38	49,4	57	76	91,2	114	133	228
39	50,7	58,5	78	93,6	117	136,5	234
40	52	60	80	96	120	140	240
41	53,3	61,5	82	98,4	123	143,5	246
42	54,6	63	84	100,8	126	147	252
43	55,9	64,5	86	103,2	129	150,5	258
44	57,2	66	88	105,6	132	154	264
45	58.5	67,5	90	108	135	157,5	270
46	59,8	69	92	110,4	138	161	276
47	61,1	70,5	94	112,8	141	164,5	282
48	62,4	72	96	115,2	144	168	288
49	63,7	73,5	98	117,6	147	171,5	294
50	65	75	100	120	150	175	300
51	66,3	76,5	102	122,4	153	178,5	306
52	67,6	78	104	124,8	156	182	312
53	68,9	79,5	106	127,2	159	185,5	318
54	70,2	81	108	129,6	162	189	324
55	71,5	82,5	110	132	165	192,5	330
56	72,8	84	112	134,4	168	196	336
57	74,1	85,5	114	136,8	171	199,5	342
58	75,4	87	116	139,2	174	203	348
59	76,7	88.5	118	141,6	177	206,5	354
60	78	90	120	144	180	210	360
61	79 3	91,5	122	146,4	183	213,5	366
62	80,6	93	124	148,8	186	217	372

Normal Hydrochloric Acid 1:10 cc per litre Water	Grammes of Acetic Acid necessary to correct 100 litres Water					
	12° Tw.	10½° Tw.	9° Tw.	7½° Tw.	6° Tw.	4½° Tw.	3° Tw.
63	81,6	94,5	126	151,2	189	220,5	378
64	83.2	96	128	153,6	192	224	384
65	84.5	97,5	130	156	195	227,5	390
66	85.8	99	132	158,4	198	231	396
67	87.1	100,5	134	160,8	201	234,5	402
68	88.4	102	136	163,2	204	238	408
69	89,7	103,5	138	165,6	207	241,5	414
70	91	105	140	168	210	245	420
71	92,3	106,5	142	170.4	213	248,5	426
72	93,6	108	144	172,8	261	252	432
73	94.9	109,5	146	175,2	219	255,5	438
74	96,2	111	148	177.6	222	259	444
75	97,5	112,5	150	180	225	262,5	450
76	98,8	114	152	182,4	228	266	456
77	100,1	115,5	154	184.8	231	269,5	462
78	101,4	117	156	187,2	234	273	468
79	102,7	118,5	158	189,6	237	276,5	474
80	104	120	160	192,4	240	280	480
81	105,3	121,5	162	194,8	243	283,4	486
82	106,6	123	164	196,8	624	287	492

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